PAPERS

IN

MECHANICS.

The SILVER MEDAL *of the Society and* TWENTY GUINEAS *were this Session voted to the Rev.* JAMES BREMNER, *Minister of Walls and Flota, Orkney Islands, for a Method of making any Ship's Boat a Life-Boat to preserve the Lives of the Crew in imminent danger. The following Communication was received from him, and an Explanatory Engraving is annexed.*

SIR,

I HEREWITH send you a copy of my plan for converting every ship's boat into a temporary life-boat; and without using a single argument more than the account contains, I leave the matter entirely to the judgement of the Society, but not without hope that it will meet their approbation.

In that case the recommendation of so respectable a body, whose institution is solely designed for promoting public good

good, cannot fail to have a very powerful effect towards removing vulgar prejudice, which is generally difficult to overcome, and which in the present case is the only obstacle that can be adduced to prevent the universal adoption of the plan proposed.

I remain, Sir,

Your very obedient and humble Servant,

JAMES BREMNER.

Walls Orkney, Sept. 16, 1809.

To C. TAYLOR, M. D. SEC.

On the Preparation and Uses of Ships' Boats as Life-Boats.

HAVING a great many years ago witnessed a melancholy scene of shipwreck, and seen men perishing at little more than the distance of one hundred yards from the shore, it forcibly struck me, that though there was no possibility of getting from the shore to them, yet there was a great probability that means might be found, by which those in such situations might with safety be enabled to effect their escape to the shore; and further considering that the very precarious aid of some accidental piece of wreck (under every disadvantage and in a tempestuous sea) sometimes serves to save life, I was confirmed in the opinion, that some method might be devised, which, upon good grounds, would hold forth the promising prospect of safety in all the common

and

and general cases of shipwreck. Hence it was that to devise such a scheme became the object of my research ever after.

The following plans (especially the first) are so simple, and the effect so obvious, that I cannot allow myself to think, that any seaman can entertain the smallest doubt but that a boat so prepared would live in any sea whatever, could neither sink nor overset, and could carry in safety a number of people, in proportion to her size, over a bar, or from the wreck to the shore through any surf.

That empty casks must float, almost wholly above the surface of the water, is so clear, that no person can be so absurd as to question it; and it is equally certain that every cask will support weight of any kind in proportion to its size. In order then to accomplish the end proposed there is only one thing more wanted, and that is, by means of sufficient seizings or holdings, to secure the casks in their places. Were you to tell a seaman that he is not master of this mighty operation, it is easier to conceive than to express the contempt he would feel, and the energetic reply he would probably make to such a supposition. If then these are undeniable points, it must follow, that wherever the boat can be had recourse to, all that is contended for in the plan must be granted.

It no doubt has been upon these simple and obvious principles that those corporate and public bodies, and hundreds of seamen to whom the plan has been communicated, have so readily and entirely approved of it. But however respectable and authentic these testimonies (afterwards to be mentioned) may be, I lay no stress upon that point, neither do I ask any credit for it, but freely submit my statements to the great body of seamen in general, leaving them to be judged of, not with liberality only, but with severity, con-

sidering that it would be a crime of the first magnitude, to advance a single argument or suggestion that could have the smallest tendency to mislead, in a matter so solemn and important, as where life and death are concerned.

Were I to go back to cases that are well known to have happened, I could easily point out many, wherein this plan had been thought of, there can be no doubt but it would have been attended with the happiest consequences; and probably the recollection of many seamen may furnish cases of the same kind, which have happened within their own knowledge.

I shall only add, that I expect no benefit nor advantage whatever to myself from my perseverance and labours on this subject, nor reimbursement for an expense of some hundred pounds which it has cost me in repeated journies to Edinburgh and London, as well as in experiments, which a living of less than seventy pounds a-year could very ill afford; but I shall nevertheless reckon myself amply rewarded, if what I have to propose shall at any time, or in any case, prove the means of relieving from the deepest distress, and of rescuing from otherwise inevitable death, even a few of those who have had the misfortune to be involved in all the horrors of shipwreck.

Mariners are unavoidably exposed to incomparably greater hardships and sufferings, than what are to be met with in any other line in human life.

Whilst the labours of all others are moderate, and find relief at stated intervals by day, and repose by night, the seaman must contend with the storm so long as it lasts, and encounter danger at a moment's warning, whether at midday or midnight. Whilst the tempest rages, no respite can be allowed him; he must keep his station without intermission, and after toiling above strength and above measure, it is often his hard fate to be shipwrecked at last.

The

The complicated distress attending this frequent and fatal disaster, it would be in vain to attempt to describe in any words, nor is it possible to conjecture nearly the number which is added annually to the innumerable multitude of dead which the ocean contains.

Sometimes several hundreds in one ship are involved in this direful calamity, where the misery of each sufferer is increased, in proportion to the accumulated woe that surrounds him; the cry of despair is heard on every side, and in distraction each exclaims, What shall we do?

Amidst overwhelming waves and wreck, the mariner suffers in his person all that a living man can undergo, and in his mind all the anguish that despondence can create, heightened by the agonizing thought, that he is never more to behold wife, child, family, or friend; still however amidst all his sufferings, an ardent love of life prevails, and the hapless mariner, struggling hard to preserve it, clings to whatever seems to promise a momentary reprieve.

In the mean time the wreck is rapidly giving way, some are washed away in one place, and others in another; those who remain redouble their efforts for life; but alas! they strive in vain; one decisive blow has dashed their last and only support to pieces, and all are going down together—a general shriek is heard—to be heard no more! the melancholy scene has closed, and neither survivor nor wreck is left behind.

Any plan then that has for its object to afford relief in situations of such extreme distress, and which seeks to extend the same benefit to thousands of perishing men in future ages, will no doubt meet with a favourable reception from every humane and benevolent mind.

But humanity and true benevolence, are not merely

speculative, but active principles; and wherever they really exist, the helping hand is instantly stretched forth, to execute the dictates of the feeling heart.

As no subject can be more interesting to individuals than the present, nor more important to society, may it not then be expected, that every friend to humanity and to his country, will not only heartily wish success to the present plan, but also lend his best assistance to have it brought into all the practical effect, of which it may be found susceptible.

It is to be understood, that the plan is intended to apply to cases of shipwreck in general, and that it may very often succeed even in cases of extraordinary difficulty and peril.

This will comprehend the far greater number of all shipwrecks that happen, and the author thinks himself warranted to say, that no solid objection can be offered to the effectual operations of his plan to this extent, and that it will be found fitted to answer all the purposes of a life-boat, by saving lives, where otherwise men must inevitably have perished.

At the same time he begs it may be understood, that he does not speak with this confidence, from his own opinion only, however well-founded in principle and experiment it may be, but because the plan itself, after repeated investigation, has received the unanimous testimony and approbation of professional men, and of men too who must be allowed to be the most competent as well as the most respectable judges in the kingdom, namely, the Trinity House of Leith, in whose records a copy of it will be found.

The Report of the Highland Society of Scotland confirms that in their Committee appointed to witness the experiment at Leith, there were naval men of that number who were competent

competent judges, and in whose skill they could confide, and for this reference is made to the Appendix of their second volume.

It has been repeatedly submitted to the Trinity House of London. It was first transmitted to them by Lord Melville, the treasurer of the navy, and their answer under the hand of their secretary is inserted in the forementioned Appendix, signed James Court.

In the next place, the plan having been laid before the Royal Humane Society, and they not being naval men, do submit every essay of that nature to the Elder Brethren of the Trinity; and in consequence of their approbation a premium of five guineas was given by the R. H. S. as appears from their printed Reports 1800 and 1801.

And to these attestations, might be added, the subscribed approbation of more than one hundred ship masters, whom the author had occasion to see only accidentally, and whose subscribed names are now in his possession.

It is under the sanction of such authorities and documents that it is now offered to the public, and they are such as must be satisfactory to every impartial and candid mind.

They have been obtained without interest, favour, or friend, and small premiums have been given without the author's knowledge, till informed by letter that his plan had received this mark of approbation.

It is impossible therefore to ascribe so honorable testimonies and gratuitous bounties to any other motive than to the conviction of the utility and efficacy of the plan, and an ardent desire to promote an object so devoutly to be wished, as the preservation of lives in cases of shipwreck.

The inventor trusts that his statements will shew, that he is not unacquainted with his subject: and he shall only add, that he has had more than forty years experience in the use

of boats, among dangerous tideways and rapid currents, such as the Pentland Frith, and all the other channels among the Orkney Islands; and that he has been several times at sea on shipboard, in storms that were attended with shipwrecks; and that from such experience he is perfectly convinced that his plan is sound and unexceptionable, and is confident that the period is not very distant, when it will come into as great repute and general use as life-boats, properly so called, are now known to be.

The plan may be executed upon boats of all dimensions, and the largest, provided they could be got out, would be found the most advantageous; but all circumstances considered, the size deemed in general best adapted for the purpose would be any boat from sixteen to twenty feet in length, which is to be prepared as follows.

Reference to the Plan of the Rev. Mr. Bremmer's Preparation of Ship Boats as Life-Boats, Pl. 5, Fig. 1 and 2.

Two additional ring-bolts are to be fixed in the keel within-inside of the boat.

One to be placed one-third of the boat's length from the stem.

The other one-third from the stern.

Two augur bores are to be put through the keel without-side, and close to the garboard stroke.

One of these bores to be put about half way betwixt the ring in the stem, and that next to it in the keel.

The other about half way betwixt the ring in the stern, and that next to it in the keel.

Plugs

Rev.d Mr. Bremner's Life Boat.

Fig: 1.

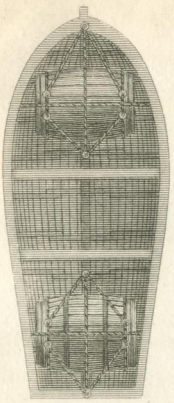
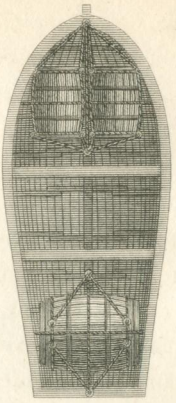


Fig: 2.



Mr. Hemman's Mooring Block for Ships.

Fig: 3.

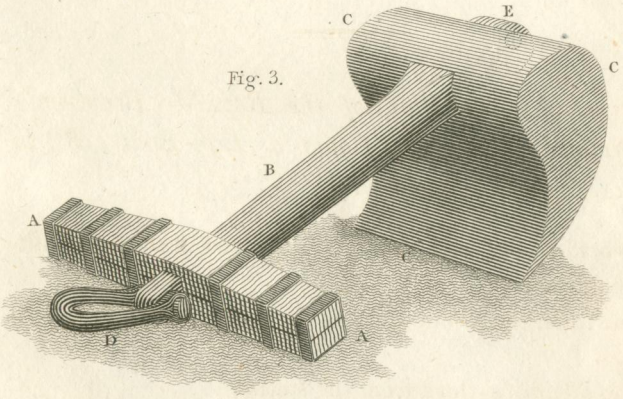


Fig: 4.

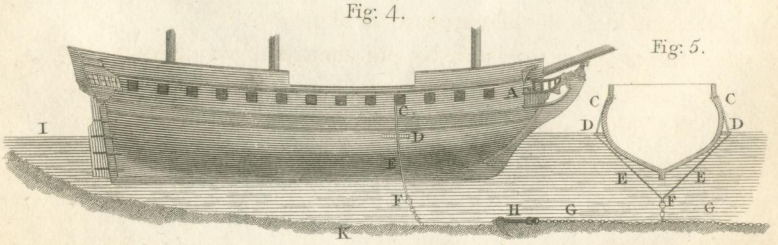


Fig: 5.

Drawn by J. Farey Junr.

Engraved by S. Porter.

Plugs may in ordinary be put into these bores, to be struck out, when occasion requires.

Those ring-bolts which are in ordinary in every ship's-boat, the two additional ring-bolts in the keel, and the two augur bores, are all intended as secure points of fixture, to which seizing ropes are afterwards to be attached.

In the next place, two tight empty casks, (see fig. 1.) are to be provided, of such dimensions that their length may fit to the width of the boat, when laid athwart ship, and their diameters to be about three feet, and if larger so much the better.

Each cask must be furnished with a sling on each end, and each sling to have two eyes on it, about six inches asunder, and the slings so put on the cask as that the eyes may be on the upper side when laid into the boat, that the seizing rope may pass through those eyes, in their way from ring-bolt to ring-bolt.

One of these casks, so prepared, is to be laid in foreward, and the other aft, and each cask so near its respective ring in the keel, as only to leave sufficient room for passing the seizing rope through the ring in the keel.

By this means, the vacant space to be then filled up with cork, will be left betwixt the cask and the bow foreward, and betwixt the other cask and the stern aft.

The requisite quantity of cork, according to the dimensions of the boat, and the quality of the cork, may be about a hundred and a half, or two hundred weight, for each end of the boat, and that for each end ought to be made up into two separate bundles, each bundle being fitted to the width of the boat, and the uppermost one forming an arch from gunwale to gunwale.

The cork is to be made up in canvas, done over with soft

pitch for preservation, and each bundle marked and numbered according to its place.

The cask and cork being laid into the boat, seizing ropes are then to be applied for securing them in their places.

Here it is to be observed, that the single turn of rope which is to go through the augur bore in the keel and round all, should be the first made fast, that the other seizing rope (which we shall suppose to have been made fast to the ring in the stem) may, in passing through the eyes on the sling, take in the surrounding rope betwixt the two eyes, which will thereby prevent the surrounding rope from slipping to either side of the cask.

The seizing rope having passed through the eyes on the sling, is then to be passed on through the ring in the keel, and thence back again in the same manner, through the eyes on the sling on the other end of the cask, to the ring in the bow; and lastly, the seizing rope is to be brought directly from the ring in the stem to the ring in the keel, by which it will cross the cask at the bung or middle part of it: the other cask and cork aft are to be secured in the same manner.

The preparation will be completed by attaching a bar of lead or pig-iron, of about two hundred weight, to the keel within side, by means of the ring-bolts in the keel or otherwise.

The same plan may be executed with equal effect, and nearly with the same expedition, by the following alteration and arrangement.

Instead of one large cask, two lesser ones may be used in each end of the boat.

These are to be laid in lengthwise, fore and aft, in the boat, along side of each other, and both together ought to fill the width of the boat.

These must also be furnished with slings on each end, and with two eyes on each sling, and these eyes so placed as to be about two inches above the horizontal diameter of the cask, one eye being on each side of the cask when the sling is put on.

The seizing-rope being now made fast to the ring in the stem, is to be passed through the eyes on the slings on one side of the cask, then through the ring in the keel, and so back again through the eyes on the slings on the other side of the same cask, to the ring in the stem. The rope is then continued on till it has passed in the same manner on both sides of the adjoining cask, and the last turn is to be made directly from ringbolt to ringbolt, passing over and above the surrounding rope, which will thereby be brought down in the middle betwixt the two casks, and made closely to compress them on each side.

The same process is to be followed as to the casks aft, where the dimensions of the boat will admit of it, and where otherwise one large cask athwart ship may be used, as in the plate, fig. 2. It was in this manner that the experiment at Leith, hereafter to be detailed, was made, and all the cork that was used on that occasion, was about one hundred weight put into the narrow part of the boat aft, in order to raise a common porter cask placed above it to a convenient height. The preparation of the cork bundles in this case will differ somewhat in their shape from those in the former plan, but as the purpose of them is the same, namely, to fill up the vacant spaces betwixt the cask and the boat, a particular description of them seems quite unnecessary; only it may be observed, that as the diameters of the cask foreward are considerably less than that in the former plan, so much of the cork ought to be placed underneath, as may serve to raise the upper side of the cask about four inches above

above the gunwales, it being evident that the higher they can be raised with sufficient security, the more effectually all possibility of overturning will be prevented.

The same quantity of ballast is to be used in this case as in the former, and is to be applied in the same manner.

With respect to boats of small vessels, a single cask forewards and another aft, without any cork, will be sufficient.

Each cask to be about the size of a hogshead, and to be set on end, or leaning obliquely towards the rings in the stem and stern, to which they are to be secured, and at the same time to two other rings placed in the keel, proper for that purpose: these casks, from their position and power, would effectually prevent sinking or upsetting: and as the crews of such vessels are few in number, their boats might support them safely through any breach into shallow water.

The foregoing plans are founded upon unquestionable principles, and constructed according to a regular method. They keep in view the difficulties to be encountered, and provide against them by making a few necessary preparations in due time.

Were this attended to, all the confusion and embarrassment which arises from sudden alarm, and the distress that must attend a total want of suitable means, would be prevented, and an encouraging prospect of safety held out even in the most perilous situations.

The want of timely forecast, and the neglect of means that were in our power, never fail to occasion the bitterest self-reproach, and the most painful vexation, whenever we are overtaken by misfortunes, which a little prudence might have prevented.

Having however but too much reason to apprehend that such prudential provisions as have been stated, will still be neglected, in spite of every suggestion and consideration that

that can be urged, I shall now propose a third plan, which, though inferior to the former, as a ship with jury masts, torn sails and a temporary rudder, is to one in perfect good condition; yet, considering that this inferior plan, like the disabled ship, may gain what was despaired of, and save what was given up for lost, I proceed to state it:—

This plan will consist in the application of cask only. These, if stowed closely and so as to fill up as well as possible one-third part of the boat forward, and one-third aft, would effectually prevent the boat from sinking or oversetting.

Upon this plan, in order the better to secure and combine the cask, the end of a sail should be in the first place thrown into the bottom of the boat, and the cask being stowed upon it, the other end of the sail should then be doubled over all: the seizings are then to be made through holes struck any where through the bottom and sides, wherever the passing of a rope may be found necessary, or of any use for confining the cask.

The constant and general idea, that the utility of every boat depends upon the tightness of her bottom, and her completely resisting the admission of water, opposes itself strongly, and almost irresistibly to the directly opposite idea, that water freely admitted could do no injury; nay, so strong is the received opinion, that it may be very difficult to pursuade some, that large openings in the bottom would prove a real advantage; it is however undoubtedly true, that in the present plan this would really be the case.

It is therefore very material to observe, that neither the number nor the size of the holes struck through, are of any consequence, as to the water in the boat; on the contrary, they would be so far from being detrimental, that, to a certain extent, they would be of advantage, as they would serve to discharge, in proportion to the buoyancy contained, whatever

ever top-water might be withinside, above the level without, and which the boat would otherwise retain as a load and dead weight, if she were every were perfectly tight: whereas, in proportion as the buoyant power operated in raising her, the top-water would instantly subside through the holes in the bottom, and thereby render her more lively, and to swim higher out of the water.

From not attending sufficiently to the fact now stated, it has probably happened, that the plan we are at present describing has never been attempted; but whoever will take the trouble to consider the matter for a little may soon be convinced that they may, *without scruple or hesitation, make as many holes, and of whatever size,* as they may judge necessary for passing ropes, wherever they can serve for effectually securing the casks in their places.

The only point chiefly to be attended to, is never to attach ropes to any tender part of the boat, such as the gunwales or thwarts, but to such parts as possess the greatest strength, and in which entire confidence may be placed.

As the largest boats have strong timbers, this plan might probably succeed best if applied to launches and long-boats.

Small anchors that have iron stocks, and which could be laid in the bottom of the boat, would serve for ballast, though probably ballast in large boats would not be very necessary.

The holes to be struck through may be pierced with a marling-spike and mallet betwixt the timbers.

The power and effect of empty casks is well known, the application of them being a common expedient, used almost every day for the purpose of floating stranded or bilged vessels of great burthen.

How easy then it must be, by the same means, to render a boat buoyant to any degree that could be wished, may be abundantly

abundantly evident to every person not obstinately blind to undeniable fact.

The thing is so self-evident as to require no proof, that if both ends of the boat be tolerably filled with empty casks, she will not only thereby be secured against upsetting or sinking, but will be rendered extremely buoyant, provided the casks be effectually secured in their places; and in full proof of this fact, the experiment hereafter to be narrated, was made almost entirely with empty casks.

The inventor having little hope that the far better and more eligible plan by timely preparation will be adopted, is the more solicitous to gain attention to this third mode, by means of cask only, because necessity, which is often the mother of persuasion as well as of invention, may compel the unfortunate mariner to have recourse to it.

Seamen being above all others expert in the use of ropes, and expeditious in making secure seizings, which is the great and only thing wanted, the inventor begs leave confidently to affirm, that whenever it shall be tried it will be found perfectly safe and successful.

Let therefore no scruple or hesitation be made in striking holes through the boat, any where, and of any number or size that may be found necessary for passing ropes for the effectual confinement of the casks. This plan will apply *not to one boat only, but to every boat in the ship*, provided there be a sufficiency of casks on board.

If then the two great points upon which I set out, namely, the powerful buoyancy of cask, and the peculiar expertness of seamen in every operation where ropes are to be used, be duly considered, they will sufficiently vindicate and verify all that I have stated; and unless the one or the other, or both, (that is, the power of cask, and ex-

pertness

pertness of seamen) can be shown to be false assumptions, the conclusions which I have drawn, can neither be denied nor resisted.

Observations and Remarks relative to the foregoing Plans.

1.—From the detail in the description it may be alleged, that the situation would not admit of so much time as the preparation would require.

It is granted, that in some cases this might be true, if nothing had been done before-hand; but surely such neglect ought by no means to be imputed as any defect in the plan, but ought to be ascribed to its true cause, the remissness of those who would give themselves no trouble to avail themselves of it.

Slings fitted to the cask, two additional ring-bolts, two augur bores, and the requisite quantity of cork, are all things so trivial and so easy to be provided, that to be without them must appear an unpardonable neglect, and if these were in readiness the short space of ten minutes would be quite sufficient for laying them in their places, and securing them.

It is evident to demonstration, or it might be easily proved by experiment, that with respect to the two first methods stated, and where the necessary provisions had been made, that the whole could be executed in ten minutes, and therefore any objection in point of time can have no place.

2.—When there is a prospect of the ship holding together for some time, the boat may be kept in readiness and

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in reserve, or may be served on shore by a rope, and hauled off again, as often as occasion may require; and if to be hauled off, it might be a necessary precaution to pass a rope round her lengthways to assist the ring-bolt in the bow, and in every case the attachment and connection of the boat with the vessel ought to be well secured till the moment she is to be cast off for the shore.

3.—It is of no consequence in what manner this boat is to be got into the water, whether after-end or side, by means of handspikes or otherwise, as no water can hurt her, though it might be more desirable, if it could be done without filling her in midships, as in that case she might be conducted through very heavy seas without filling at all, or receiving more water than might be easily baled out.

4.—It is material to remark, as it may not generally be attended to, that the plan always supposes the midships to to be full of water; but that the requisite buoyancy of the boat is not injured by that circumstance, nor will the addition of people, in so far as they are immersed in the water, prove any additional burthen; this will be perfectly clear to all who understand this part of the subject, however improbable it may appear to others, and the remark serves to shew that it would be a good rule, in such circumstances, for the men to keep themselves immersed in the water in midships as far as possible.

The idea of placing men in the midships of the boat whilst at the same time it was full of water, would probably startle a landsman not a little; such therefore may be told, that every life-boat is supposed full of water, and that to imagine there could be any man in one with a dry thread about him would argue a total ignorance of the matter.

5.—It is to be kept in mind that the danger is always supposed to be extreme, and that the present plan affords the

the only posssible chance of saving life; therefore whatever hardship or difficulty there may be in putting it in execution is entirely out of the question; any other view of the subject is altogether foreign to the purpose.

6.—If any are of opinion that cork ought alone to be used for buoyancy, there can be no doubt of its answering the purpose perfectly; at the same time the author is of opinion, that a combination of cork and cask would be found more convenient, and in some respects preferable.

Water-casks would always be at hand, and to save the expense of cork, might on that account be preferred by some; but independent of this consideration, casks are by more than one-half lighter than their bulk of cork, and thereby more than a double advantage in favor of buoyancy is gained by using them.

There is but one objection to the use of casks, and that is, that they may be stove in; but if the great strength which they possess from their construction be considered, and at the same time that they are strongly defended by the boat, this objection must appear of no moment at all.

7.—Every boat, prepared as has been stated, is fit to carry mn equal in weight to something more than one-third of the boat's whole burthen, and one of eighteen feet in length can carry from fourteen to sixteen people, and have sufficient room for working a pair of oars, which ought by all means to be short ones.

The disadvantage of working long oars upon a low gunwale, and in a high running sea, is too obvious to need any thing more than to be just mentioned.

8.—As all depends upon the points of fixture, too much attention cannot be paid to their sufficiency, and though those stated in the plan, are judged to be perfectly adequate to the purpose, yet any person wishing for more, *may add them*

them at pleasure, by rings of rope in the stem and stern-posts, as in the Greenland boats, by more rings in the keel, or in addition to the seizing-ropes, a netting of small rope may be made to cover the whole foreward, and another such may be applied in the same manner aft, and by these means every possible security that can be desired may be obtained.

9.—It is material to observe, that no dependence ought to be placed on seizings connected with the thwarts or gun-wales, unless it were only as aids to the points of main dependence.

The gun-wales, more than any other part of the boat, are liable to damage, and may very possibly be injured in hoisting out, or before getting clear of the vessel.

The two augur bores in the keel are infallible holds; easy access may be had to them while the boat is on deck, and a rope may be passed through them in a moment.

This seizing, besides the security it affords for confining the buoyancy, adds considerably to the strength of the boat, and therefore ought to be preferred to any other mode of fixture.

10.—No rule can be laid down that will fit all boats, as to the precise quantity of cork, or size of cask, their shape and dimensions being so various; but from the general rule that has been stated, and the purpose to be served, every man may easily adjust his apparatus to his boat, or make such little alterations on the boat as may be found convenient or necessary.

11.—No sail can hurt this boat, as it is supposed she has only to go right before the wind, and therefore a sail may be used with very great advantage. This would render oars unnecessary, and would be infinitely preferable. It is almost needless to add, that the boat could be steered in midships.

12.—The great benefit derived from the common life-boats is well known, and universally acknowledged; but they are very far from being adequate to the calamity they are intended to remedy.

Their number comparatively is very few, and the sphere of their operations extremely limited.

In darkness by night, and in thick snow by day, when their aid is most wanted, they are of no avail.

Storms may blow, and sometimes have blown so hard as to defeat their utmost exertions, and even in the most favorable cases, require a considerable time before they can reach the wreck; in the mean time the vessel may be dashed to pieces, and all hands lost.

The very pre-eminent advantage of the ship-boat in these and several other respects is very conspicuous.

This boat is wherever the ship is, and recourse may immediately be had to her; is of equal utility by night as by day, and in the thickest as well as in the clearest weather; and whilst the life-boat, with extreme slow progress, must be impelled against wind and sea by a force superior to both, the ship-boat has only to drift with ease before the storm.

13.—As it may serve to gain confidence with those who are not otherwise qualified to judge of the plan, it may be observed, that the ship-boat is prepared upon the very same principles as the life-boat, and that these principles are applied to greater advantage in the former than in the latter. The quantity of buoyancy in the ship-boat, being considerably more in proportion to her size, and being carried to a greater height, gives more security against oversetting; and if to these advantages there be added the far greater one, of having only to drift before wind and sea, no shadow of doubt remains of the success of the ship-boat over that of the other.

Lastly.

Lastly.—This plan carries with it the very strong recommendation of private interest as well as of public utility.

Suppose a ship to be riding in an open bay or road-stead, a storm comes on, and if in winter, a long dark night is soon to follow.

In this situation the mariners being extremely doubtful whether the vessel could hold it out over the night, and terrified at the awful prospect of being thrown, as it were, blindfold into the most perilous of all situations, the determination would most undoubtedly be to cut and let the ship on shore while there was light, as giving the only chance for saving life.

The same determination may be taken in hopes of escaping by favor of a falling tide, and in both cases lives, ship and cargo may be all lost, as has certainly very frequently happened.

Whereas could safety be ultimately relied upon from the boat, the ship would be allowed to ride so long as anchors and cables could hold her, and in the mean time the storm abate, the wind might shift, or her tackling might prove sufficient to outride the storm, and thus lives, ship and cargo would all be safe.

In every situation the prospect of safety by means of the boat, would prevent every precipitate measure, and encourage men to make those exertions for saving ship and cargo, which are not to be expected from men despairing of life.

In the foregoing plans there is nothing that can be reckoned complex, nothing that requires nice adjustment, or of doubtful and precarious effect.

They are unquestionable in principle, simple and easy in execution, and absolute in security; and if the necessary previous preparation, which is very little, has been made,

they will be found as expeditious as any emergency can require.

They have been proved by experiment as far as circumstances would permit, and have received the unqualified approbation of naval men of the greatest experience, and of the first respectability.

These are the solid grounds upon which they are offered to the public in general, and most earnestly pressed upon the attention of seamen in particular.

The plan having been communicated to hundreds of seafaring men, they have always given it their ready and entire approbation; hence it is hoped, that every seaman from his own knowledge and experience, without any doubt whatever, will, upon considering the subject, be fully convinced in his own mind that the scheme is perfectly practicable, and if adopted, would be attended with the happiest effect.

Deeply impressed as I am with the importance of the subject, I shall be forgiven if I again repeat it, that shipwreck presents to our view distress heightened by every circumstance that can awaken sensibility, or excite commiseration.

To be exposed to the shock of overwhelming waves,—to contend long in one continued struggle for life,—to be bereft of every hope,—and given up to despair; constitute the deepest affliction in body and mind that human nature can undergo.

In this situation oft does the sufferer wish (which some who have narrowly escaped declare) to give up the painful contest; but nature refuses to resign, and keeps her hold so fast, that sometimes death itself has not been able to disengage it, for friends after death have been found fast locked together in each other's arms.

If

If this subject be considered in a political view, it must strike every mind, that the preservation of the lives of our seamen is united with that of our independence and very existence as a free nation.

Our seamen are the bulwark and palladium of our lives and liberties, and upon them alone, under God, depend all our greatness as a maritime power, and all our prosperity as a commercial people.

The ocean is their element, and every region from the vertical sun to the frozen pole is alike the scene of their diversified labours and manifold dangers.

Those necessaries, conveniences and comforts of life which nature has scattered widely throughout the terraqueous globe, they collect, transport and exchange, to the great benefit and general advantage of the human race.

It is to them that Britain stands indebted for the traffic of all nations, the wealth of both Indies, and the empire of the ocean.

The glorious victories they have lately achieved, and by which they have annihilated the navies of Europe—their skill—their courage—their fidelity, have justly merited all the applause, gratitude and rewards, that their country can bestow. Would it not then be culpable—would it not be criminal, to leave unattempted any means that have even the smallest probability of being useful in preserving the lives of so valuable and important a part of the community?

The regular plan which has been stated (to say the least of it) holds forth a very probable means of saving, annually, several hundreds of able and experienced seamen, and consequently would, in a very few years, furnish a reinforcement of thousands to our naval strength, and that too from a resource altogether new and unlooked-for, and at the same time without any trouble or expense.

Substitutes and Expedients which may be found useful.

1.—If so much cork was made up in canvas as would serve to go quite round the boat withoutside, and reach from the top of the gun-wales to about fifteen inches downwards, and of one foot in thickness; the same might be attached to the boat, and would render her extremely buoyant. This, together with ballast, and a small quantity of cork withinside, would render a perfect life-boat, upon almost the very same plan as the present life-boats.

The cork might be made up in so many separate parcels, (netted in small rope,) as was found convenient to be attached to a strong rope going round the gun-wale, and to another such which ought exactly to fit the girth of the boat where the cork reached to below.

As the cork would only press upwards, and always against the bottom and sides of the boat, it is evident that if the lower rope fitted tightly, the cork would keep its place; and in order to secure that point a few turns of rope passing from the lower edge on the one side over the keel to the lower edge on the other side would fix it completely. A very few seizings attached to the gun-wale rope passing from the one side to the other would be quite sufficient.

The separate parcels must be furnished with loops or ends for attaching them to the main ropes, and to one another.

2.—Several ring-bolts might be put into the keel withinside, and ropes, single, double or treble, might be passed through these rings before laying in the buoyant materials, and then these ropes might be brought round the whole contents and made fast.

3.—It frequently happens that seamen, after they have gained

gained the shore, find they have only escaped one death to perish by another still more miserable.

Drenched in water, chilled to the heart with cold, worn out with fatigue, and exposed to all the severity of inclement weather, without shelter or succour, it is impossible but that the remains of life must soon be extinguished.

In this situation, and it is far from being uncommon, dry clothing would be as precious as life itself, and it might be by the following expedient:—

Let a *leathern* bag be made for containing some shirts, a waistcoat or two, and two pair of drawers, all of flannel.

Let this bag be made of a length and size convenient for the purpose, and for tying round under the arm-pits.

This would serve the purpose of a cork-jacket in the water, and prove a second time as life from the dead, by affording dry and warm clothing upon gaining the shore.

By this expedient every man may be made a swimmer, and sometimes one man by swimming has been the means of saving the whole ship's company.

It may be proper to observe, that the larger part of the bag should be placed high upon the breast, and the other or back part no higher than the arm-pits, as in the act of swimming, the back part of the shoulders is little more than just covered with the water.

The bag must be perfectly water-tight, and only moderately filled; both ends of it may be left open to be closed with a tight seizing of small line.

The expense of this preparation would hardly cost five shillings.

4.—If it were intended only for swimming, a neat and commodious preparation might be made with cork covered with thin leather, to be applied in the manner which has just been described.

It might be fitted on with clothes or without in half a

minute, and made fast by a knot or clasp on the breast; three pounds of good cork would be sufficient to support any man, and the expense no more than in the former case.

5.—Another expedient bids fair for obtaining a speedy communication betwixt the ship and the shore, by means of a kite.

It is the property of this machine, to ascend in proportion as the cord is spared off.

To manage this, and to bring the line within reach on shore, let a piece of light wood, about the size of a small handspike, be attached to the line, about twelve fathoms from the kite; the line to be fixed to the forepart of the stick, and so as to pull only there, and then being slackly laid along the stick, made fast to the other end: by this means the kite would be prevented from rising higher, and would, at the same time bring the line to the shore from the ship, and by this small line a rope might be hauled from the ship by any spectator on the shore.

A silk-handkerchief, and a piece of wooden-hoop, might soon furnish a kite.

6.—Sometimes people are seen to perish, where those on shore, and those on the wreck, are almost within grasp of each other.

In this case, if there happened to be a mast standing, a common ensign made fast to a stick, just strong enough to keep it spread, and quickly spared off from the mast-head, would probably reach the shore without touching the water, or at least drift on shore with a small line attached to it.

No experiments having been made upon these substitutes and expedients, they are barely mentioned, as things that might possibly succeed, and are thrown out as hints for others to improve upon, after much consideration on my part.

Extract

Extract from the Transactions of the Royal Humane Society, and of the Highland Society's Transactions.

" The horror of actual or even of threatened shipwreck may in some degree be imagined, but it is impossible to convey adequate ideas of the feelings of those who are subjected to such direful calamities.

" That person therefore who, with unremitting perseverance and assiduity, prosecutes for years any scheme calculated to alleviate misfortunes so great, and which till of late were so little, as it was thought, within the power of human ingenuity to mitigate, merits well, not of his own country alone, but of all countries where navigation is known or practised. To such merit Mr. Bremner, a clergyman in a detached part of the British dominions, and thereby excluded in a great measure from the patronage of those in power, is well entitled; because it is obvious, that in prosecuting and making public his scheme, he has been actuated solely by his humanity, which has received this direction from the frequent instances he has witnessed of that dreadful calamity against which he attempts to provide.

" It would appear that, for several years Mr. Bremner had turned his attention towards devising some effectual method, for saving the lives of people in cases of shipwreck; but it was not, it is believed, till the year 1798, that he first submitted his scheme to the consideration of any of the public bodies in these kingdoms. In the month of October, 1800, he addressed a letter to the Highland Society of Scotland, inclosing a representation on the subject of his proposed scheme, and which he requested might be submitted to the consideration of the directors. In that letter Mr. Bremner states as follows:—' The plan has been amply approved

approved of, in its present form, by men whose experience and abilities cannot be questioned, viz.

" 1.—The Trinity House at Leith have entered the plan upon the records of their house.

" 2.—The Trinity House of London were pleased to give the following answer—" I am now to inform you, that your plans have been perused by the deputy-master and brethren, who are of opinion that the same might prove useful in cases of shipwreck, in preserving the lives of mariners, &c.

" Signed, JAMES COURT."

" 3.—Having transmitted a copy to the Royal Humane Society of London, with no other recommendation than a blank cover directed for their secretary, I had the honour to receive the following answer—" London, 6th May, 1800, I have only time to say, that the adjudicators of the Royal Humane Society, have unanimously voted their third pecuniary bounty to you, which is five guineas.

" Signed, W. HAWES."

" 4.—In addition to so respectable testimonies, I am able to produce nearly an hundred subscriptions of captains of merchantmen; all of whom, as well as the members of the foregoing societies, were to a man utterly unknown to me: their testimony must be considered as free from any bias, and the result only of the most mature deliberation and judgment.

" The accompanying representation having been laid before the directors, they appointed a Committee of their number, (among whom were some gentlemen well acquainted with naval affairs,) to take the same under consideration, and to report regarding the practicability and probable success of the plan therein described. The report of the Committee

Committee having proved favorable to the scheme, the directors requested the same Committee to order an experiment to be made in their presence at Leith, and to report the result.

"About this period (July 1800) Mr. Bremner, being in Edinburgh, undertook to prepare any ship's-boat in such manner that she would neither sink nor be overset; or, supposing it possible that the utmost fury of a wave might overturn her, that even in that case, the boat would in a few seconds recover herself, and return to her upright position with all that was in her; and in this state be able to support above water, the whole crew of the ship to which she belonged, and with regard to all merchantmen, even twice that number, if necessary.

"An ordinary ship's-boat, having been accordingly prepared by Mr. Bremner*, he did, by actual experiment, show in the Port of Leith, that his scheme was perfectly practicable, as, in order to bring it to the most severe trial

* A ship's boat of middling size was chosen by Mr. Bremner for the purpose, and prepared by the simple addition of two ring-bolts in the inside, and two augur-bores in the outside of the keel, as points of infallible security, to which seizing ropes were to be attached; the ring-bolts within-side the keel were placed, the one forward one-third from the stem, the other aft one-third from the stern: two empty hogsheads were then placed in the forepart of the boat, parallel and close to each other, and laid lengthways fore and aft. These were secured in their places by passing the seizing-ropes round all, that is, over the gunwales through the augur-bore in the keel; as also from the ring-bolt in the stem, to that next it in the keel; taking care in doing this to pass the rope through eyes on the slings of the casks, which had been previously prepared. The same process was observed in the after-part of the boat: and lastly, a bar of iron, of about three hundred weight, was fixed to the keel on the inside, A small quantity of cork was also placed in the stern, intended chiefly to raise to a proper height the casks placed above it; but without which the result of the experiment would have been the same.

that

that the situation would allow, and as near to the utmost trial it is possible to encounter at sea, the boat, by means of tackle, was forced over till her keel became uppermost, and perpendicular to the surface of the water; in this situation, and though full of water, the moment she was left to herself she instantly regained her position upright on the keel.

" This experiment having proved so satisfactory, the Committee reported to the directors as follows :—

" In the first place, that Mr. Bremner's contrivance differs from any life-boat of which they have received information, in so far as the latter being stationed at particular ports, are intended and calculated to afford occasional relief, in those cases of danger that may occur within their reach; and though very useful and proper in their invention, are yet thus limited in their use, while they are so constructed as not to be fit for the ordinary purposes of a boat, and on these accounts are neither proper nor convenient to be carried to sea on board a ship: whereas, on the other hand, Mr. Bremner's plan is of more general application, the object of it being a simple and expeditious method of converting every boat whatever, in all situations of danger, into a life-boat, so that at the same time that a boat retains all its common utility, it may be also easily resorted to as a safe-guard against danger, and in many cases, as the only possible means of escaping from death, otherwise inevitable; where life-boats, properly so called, as well as every other means of escape, are wanting.

" The preceding opinion is sufficiently warranted, in consequence of the successful result of an experiment, which, in conformity with the wish of the directors, was lately made at Leith, for proving the practicability of the plan; when, in the presence of the Committee, as well as many other

other members of the society, and a number of seafaring people, it was fully established that a boat, fitted up in the manner recommended by Mr. Bremner, would be extremely buoyant, even when filled with water, and not only almost incapable of being overset, but that if the utmost fury of the waves can overturn her, she will instantly return to her upright situation, or in sea language, right herself.

"Although this experiment was made with casks, yet the naval gentlemen present, entertained no doubt but cork should be preferred; and they were also of opinion, that the seizing or securing the apparatus, whether casks, or bundles of cork, might be done with great security, and if all be previously ready, (as it ought to be) with such expedition as to meet by far the greatest number of emergencies.

"In consequence of the preceding report, the directors presented Mr. Bremner with a piece of plate of the value of 15*l.* 15*s.* in testimony of their approbation of his scheme; and he having furnished a general description of his plan, and the same having been approved of by the Society and several naval men to whom it was referred, it is now laid before the public, in hopes that a plan, apparently so well calculated to afford relief in cases otherwise absolutely desperate, will meet due attention from all those who are in the way of being benefitted thereby."

From the obvious similarity there is betwixt the prepared ship-boat, and the common life-boat, some have been led to imagine, that the former has been borrowed from the latter.

This I can with truth affirm was by no means the case; and to prove it beyond all question, I can refer to the evidence of a nobleman now living, the Right Hon. Lord Melville, to whom, when treasurer of the navy, I sent the outline of my plan in the year 1792, a period at which no life-

life-boat existed, nor for several years afterwards; and the plan, detailed at more length, was transmitted afterwards by his lordship, to the Elder Brethren of the Trinity of London, for their opinion thereon; upon which I received the answer, under the hand of their secretary, as mentioned in the Highland Society's Report. From whence it appears that this was the first attempt that ever had been made upon any regular plan, to find a remedy for the manifold dangers and distresses to which seamen are exposed by shipwreck.

Whether my communications and correspondence so many years before may have given rise to the life-boats or not, is a question that probably never will be solved.

I however take the present opportunity of claiming the merit of having been the inventor of a most important improvement which has been made in the use of great guns, and which is now adopted throughout the whole of his majesty's navy.

Gun-Locks to Cannon.

This improvement consists in the application of a lock to every gun, by means of which the piece is discharged at the very instant it is found to point at its object.

The consequence is so obvious as to need no explanation to any who know the difference betwixt firing with an accurate aim, and firing at random.

Formerly one person pointed the gun whilst another stood ready, at the word fire, to clap a match to it; but in the interval, however short, the piece might have deviated a hundred yards void of the mark, and therefore scarcely differed any thing from firing at random.

The use of a lock completely remedies this defect; and it appearing to me very surprising that so easy and obvious an improvement had never been attended to, I took the opportunity

tunity, when in company with the late Sir Charles Douglas, at the house of Captain Moodie, of Melsetter, Orkney, in the year 1768, to remonstrate against the mode then used by matches, and to shew the very superior advantage to be gained by means of locks; pointing out, at the same time, how easily they might be adapted to the gun, and made to serve the same purpose as a lock does to a common musket. Sir Charles had the candour readily to acknowledge that he thought the plan was practicable, adding, that he certainly should have some experiments made to try it.

It is well known that Sir Charles Douglas was the first person who introduced them into the navy, and their advantage was soon found to be so great, that every ship was immediately furnished with them; our enemies too, convinced, to their cost, of their utility, have also adopted the same plan.

This however, though it has lessened the advantage on our part, has by no means balanced it, for so long as British seamen and the British navy retain their superiority—the former in spirit, activity and skill, and the latter in the number of guns and weight of metal—so long will the improvement by locks afford a very material advantage in favor of the British navy.

Another happy consequence that has followed from the use of locks is, that far fewer accidents happen now from explosions of loose powder than formerly, when so many matches were every where continually throwing out sparks, and setting fire to spilt powder, which, like so many trains, not only occasioned the loss of limbs and lives, but hazarded the blowing up of the ship and all that was in her.

If then the improvement made by the application of locks to great guns be duly appreciated in both these respects, it will be found to have been one of incalculable national benefit and advantage.

Every

Every man has a right to claim his property wheresoever found; and, by the proof required in such cases, I am ready to verify my right to this invention.

And as it has been, and may still be of great public advantage, I consider it as barely doing justice to myself, to claim the credit of it.

JAMES BREMNER.

Walls, Orkney, Sept. 16, 1809.

DEAR SIR,

I HAVE received your letters informing me that the Society of Arts, &c. had been pleased to vote me their Silver Medal and a Bounty of Twenty Guineas, as a reward for my plan, by which every ship-boat may occasionally be converted into a temporary life-boat.

I now, through you, beg leave to acknowledge with the greatest respect and the warmest gratitude, the high sense I feel, both of the Society's liberal bounty, and of the great honor they have conferred on me by their medal.

Such marks of approbation from a Society than which there exists none more respectable, must be highly gratifying to every person who has the honor to receive them, and to me in particular they are peculiarly so. Being above all things solicitous for the success of my plan, I am sensible that the sanction of the Society must prove a powerful recommendation, serving to attract attention and to promote its adoption.

By long laborious efforts my exertions had begun to flag, and my spirits had sunk greatly, but through the powerful incentives and encouragement from the Society, they have risen

risen again, and I feel a new impulse of vigour and animation to prosecute a plan which I am confident will prove successful at all times when tried.

Were I to attend in person, it would altogether defeat the end of the Society's bounty. My situation debars me that honor, and I regret it the more as I cannot have that opportunity of testifying to his Grace the President, and to the Society, the deep sense I have of the favor and honor they have done me, and to say that it will be a proud and pleasing recollection to me so long as I shall live, and that the credit of it will be a sure and lasting legacy to my family after me.

I trust that my remote distance will be my humble apology to the Society for my non-attendance, and that you will do me the favor to receive the Society's Rewards for me.

My local situation renders a communication with London very difficult and uncertain, whenever I can find a proper opportunity, I will direct some person to call upon you for the Society's Rewards, and I will endeavour to get a model of a boat fitted up on my plan, and sent to the Society.

I am, my dear Sir, your most obliged,

And most obedient Servant,

JAMES BREMNER.

Walls, Orkney, March 23, 1810.

To C. TAYLOR, M. D. SEC.

The SILVER MEDAL *of the Society was this Session voted to Mr.* SAMUEL HEMMAN, *of his Majesty's Dock-Yard at Chatham, for his Improved Mooring-Block for Ships. The following Communications were received from him. An Explanatory Engraving is annexed, and a Model of the Mooring-Block and Drawings are preserved in the Society's Repository.*

SIR,

I REQUEST that you will be pleased to lay before the Society for the Encouragement of Arts, &c. a drawing and model of a cast-iron mooring-block, invented by me for riding his Majesty's ships, and put in practice at this port. Also a drawing of a ship riding at moorings, with some observations thereon.

I am, Sir,

Your most obedient Servant,

SAMUEL HEMMAN.

Chatham Dock-Yard, Dec. 6, 1809.

To C. TAYLOR, M. D. SEC.

Account of Mr. Hemman's Cast-Iron Mooring-Block.

This mooring-block, from its construction and weight, is decidedly superior to any anchor whatever; similar blocks (No. 12,) have been appropriated to that service at this port since the year 1801, by the Directors of the Honorable Navy Board, and in no one instance have ever been displaced,

placed, notwithstanding we have had very severe weather since that time. As a proof of their holding fast in the ground, I shall adduce the following circumstance to prove the assertion:—It was found requisite to remove one of those mooring-blocks; two large lighters with purchases in each, adapted for that purpose, with about forty-five men, were sent to weigh it, but their united powers were not adequate to the task; recourse was then had to the rising of the tide to dislodge it. The largest anchors appropriated to the moorings for a ship of the line are from sixty-five to eighty cwt. and those sizes are found insufficient at times, whereas the weight of a mooring-block is about one hundred and fifty cwt. which is sixty cwt. heavier than a first-rate's anchor, besides a form better calculated to hold in addition to its increased weight; this double advantage will allow a reduction from the length of the chain, which is very expensive; and in one pair of moorings for a ship of the line a saving of about 874 *l.* will arise out of 2472 *l.* the present expense of a pair of moorings with anchors. There is another advantage by adopting these blocks, viz.—there are no anchors appropriated to moorings but might be made serviceable; and should there be no defective anchors in store, we are necessitated to take sound ones.—I must further observe, that there is no species of stores in his Majesty's navy that is so difficult to procure as large anchors, owing to the want of anchor-smiths; and moreover an anchor of seventy-six cwt. will take upwards of thirty days to make it, whereas a mooring-block may be cast in as many hours; besides, there are but few smitheries competent to make large anchors, except in his Majesty's dock-yards; but a mooring-block can be procured at all the iron-foundries in the kingdom.—These are circumstances of the highest importance.

I was induced to try an experiment of laying down a pair of moorings of this description, from the necessity of mooring a ship in a situation where there was not room for her to swing, provided the bridles attached to the moorings came in at the hawser-holes, which is usual.

Accordingly I laid down a pair, and moored the Maidstone frigate at them; she has been there about four months, and I find those moorings answer the desired purpose. The ship turns with the wind or tide occasionally.

The bridles come in at the fourth port from forwards on each side the swivel (as shown in the plate) under her bottom; this gives facility to the ship, and keeps the ground-chain clear. Moorings of this description will answer for ships of all sizes, provided there is a sufficient depth of water under them.

SAMUEL HEMMAN.

GENTLEMEN,

WE direct you to let us know if you see any and what objections to eighteen anchors, of not less than sixty-seven hundred weight, being taken from the moorings at your port, when the season of the year and other circumstances will admit, for the use of the moorings, which are to be laid down at Sheerness for line-of-battle ships, provided mooring-blocks are furnished for your port, in lieu of the said anchors.

We are, &c.

H. PEAKE,
J. D. THOMPSON,
J. SHOMBERG.

Navy-Office, Nov. 9, 1809.

To the Chatham Officers.

CERTIFICATES.

CERTIFICATES.

These are to certify, that his Majesty's ship Maidstone has been placed at the Weathercock-moorings, within the entrance of St. Mary's creek; that I have resided on board of her since the moorings were laid down, which was in June last, and that they answer extrèmely well.

And I do further certify, that many of the line-of-battle ships in my division are moored with Mr. Hemman's cast-iron mooring-blocks; that they ride in perfect safety, and in my opinion are superior to any anchor whatever: moreover the service derives great benefit from them.

Given under my hand this 13th day of November, 1809.

A. SHENNAN,

Superintending-Master of the First Division.

This is to certify, that Mr. Samuel Hemman, the master attendant at this port, has moored a number of his Majesty's large ships in the river Medway with cast-iron blocks instead of anchors; that all these ships ride perfectly safe, and I strongly recommend the use of them in preference to anchors.

G. JOHNSON,

Boatswain and Pilot of his Majesty's Ships at the Port of Chatham for many years.

Reference to the Engraving of Mr. Samuel Hemman's Mooring-Block for Ships, Figs. 3, 4 and 5, Pl. 5.

Fig. 3 is a perspective view, wherein A A is the stock made of two beams united together by hoops, and by that means fastened round the shank B of cast-iron; C C C is the fluke, made as in the figure, of such a form as to take the greatest hold in the ground, its lower edge being sharp but the full width, so that it has an edge but no point. D is the swivel which connects the shank to the mooring-chain. E is a part of the shank projecting through the fluke, having a hole through it to receive a buoy-rope to take up the anchor when necessary. This mooring-block weighs one hundred and fifty cwt. the principle part of which is situated in the fluke, the edge of which is thereby forced into the ground so as to take good hold.

Fig. 4 and 5 explain Mr. Hemman's method of mooring a large ship in confined situations, where there is not sufficient room for her to swing if the bridles came in at the hawse-holes in the usual manner of mooring.

Near A, fig. 4, is the hawse-hole of the vessel where the bridles of the mooring-chain are generally brought in. C are the bridles in the improved method. D are wooden bolsters projecting from the ship's sides so far as too keep the two hawsers E clear of their bottom, as shewn in fig. 5; these hawsers are united in the swivel F, and this with the mooring-chains G G, which proceed to two blocks, similar to fig. 3, one of which is shewn at H, the opposite one does not come within the limits of the plate. I is supposed to be the line of low water, and K the surface of the ground.

FIFTY GUINEAS *were this Session voted to Mr.* JOHN DAVIS, *No. 7, John-street, Spitalfields, for a Method of assisting the escape of Persons, and the removal of Property, from Houses on Fire. The following Communication was received from him. An explanatory Engraving is annexed, and a complete Model of the Machine is preserved in the Society's Repository.*

SIR,

I BEG you will have the goodness to lay before the Society of Arts, &c. a machine which I have invented for more effectually saving persons and property from fire.

It appearing to me a desirable object that the public should be in possession of an apparatus better adapted for the above purpose than any now in use, I have endeavoured to strike out an entire new plan of a machine calculated for the use of a parish, which can be easily removed and adjusted to any window, with a convenient apparatus or box, moveable up or down, so as to receive persons or property. I have completed such a machine, which has answered my expectations, and been approved by several gentlemen who have seen it in action.

The machine is at Mr. James Bevan's mahogany-yard, City-road, where it shall be exhibited to a Committee appointed by the Society whenever they please.

I am, Sir,

Your obedient humble Servant,

JOHN DAVIS.

No. 7, John-street, Spitalfields, Jan. 10, 1809.

To C. TAYLOR, M. D. SEC.

Reference to the Engraving of Mr. John Davis's Fire-Escape, Pl. 6.

The plan of my fire-escape is calculated for the use of a parish; its principal consists in three ladders A B C applied to each other by four clasp irons on the top of each of the two lowermost, which are so contrived that each ladder may slide into the one beneath it; on the top of the lowermost ladder A two pullies are fixed on the inside, over which two ropes *a a* pass, and are situated between the lower A, and the middle one B. The ropes are made fast to the bottom of the middle one on each side in a proper direction with the pullies on the top. The upper ladder C is attached to the middle one in the same manner, and on the top it carries two horn-pieces D, made of iron, and turned off at each end similar to two horns which are four feet wide; their ends are sharp, to pitch on each side of a window, and with its points hold the ladders steady. The three ladders when shut down are about fifteen feet in height. They are placed perpendicular in the middle of a framed carriage E F of nine feet six inches long, and five feet six inches wide, mounted upon four wheels F. On each side of the carriage a windlass is placed; that marked G on the right side of the carriage is for the four ropes *a a* and *b b*, fixed two to each ladder A B. By turning this windlass the ladders may be wound out from their standing height of fifteen feet to forty. Over this windlass is a screw turned by the winch *d*, by turning which the ladders may be inclined against the house with all imaginable ease. On the top of the upper ladder C on the outside, are two pullies, over which two chains are conducted to the windlass H on the left side for the purpose of carrying up a box I; two of which

which travel with the fire-escape, so that in the event of one being filled with small valuables, it may be unhooked, and the other K put on, which will save time. The whole apparatus may be drawn by one horse or six men, and when arrived at the scene of danger may be adjusted in two minutes. If every parish would provide one of these escapes, and keep it where it might be brought out on the first alarm, I feel persuaded it would lessen the many accidents which occur by fire in the metropolis.

I have the honor to be, Sir,

Your obedient humble Servant,

JOHN DAVIS.

No. 7, John-street, Spitalfields, May 14, 1810.

To C. TAYLOR, M. D. SEC.

Further Observations from Mr. Davis on his Fire-Escape.

SIR,

I BEG leave to return you, and the gentlemen of the Committee, my sincere thanks, for the kind attention I have experienced; and should you think the following hints likely to give any additional information on the subject of my fire-escape, you will have the goodness to submit them to the consideration of the Committee.

Certain it is, that however good any principle may be, the practice must also be so to be effectual, therefore it is my opinion, that every parish should be provided with a machine on my principle, to be kept in some convenient place, easy of access. The key should be kept at the watch-house by night, and by day at the nearest public-house; if

if this, which ought to be, were the uniform custom, it would soon become familiar, and be attended with no expense. On the alarm of fire, I would have the machine brought out directly, as I consider it an improvident method when a house has been on fire some time, and some unfortunate sufferer should appear in need of prompt assistance, to have to search about for the keys of a church-yard, or some other obscure place, to bring the fire ladders, which when brought, if not exactly the right height, are useless, and when this which is not unfrequent, is the case, the remedy is almost as bad as the disease, witness Mrs. Smith, having fallen off a parish ladder, at Chelmsford, whilst endeavouring to save herself in that dreadful fire in March, 1808. It would be needless for me to enumerate instances, where a well-timed outward apparatus would have been of essential service—the thing is self-evident, and the occasions for their use have also been many. I would also propose that a board should be put up, offering a reward sufficient to stimulate persons to bring the machine—for example, ten pound for every life saved by it. I think no person would think it too much, who had been saved. This would have the good effect of having it always in time, which is most essential, as twenty-shillings are not sufficient to induce men to the necessary trouble attending such labour.

Having thus offered my sentiments, respecting the good effects which may be derived were certain regulations put in force,

I remain, with great feeling for suffering humanity,

Sir,

Your most obedient and humble Servant,

JOHN DAVIS.

To C. TAYLOR, M. D. SEC.

Mr. I. Davis's Fire Escapes.

Drawn by T. Faray, Junr.

Engraved by S. Porter.

The GOLD MEDAL *of the Society was this Session voted to Mr.* J. ALLAN, *of Blewit's Buildings, Fetter Lane, for his Improvements in a Mathematical Dividing Engine. The following Communications were received from him. An explanatory Engraving is annexed, and a Model of the Improvement is preserved in the Society's Repository.*

SIR,

I BEG leave to send to you, herewith, for the inspection of the Society of Arts, &c. a model of my improvement on the mathematical dividing engine, which I have lately made, containing that part which differs in principle from those made by the late Mr. Ramsden and others; the drawings or engravings of which are, I suppose, in the Society's possession. I therefore am of opinion the Society will think that the wooden-wheel I have sent with the moveable ring on its edge, will be sufficient to demonstrate its good effect in correcting the teeth or rack where the screw acts. You will please to observe, that it is cut by a screw-cutter, and it is required to go many times round the engine before the teeth are full. To effect this, I reversed the moveable ring not less than twenty times, so that I have not the least doubt of the one ring having corrected the other to a degree of perfection, which had not hitherto been obtained in engines.

This simple, easy, and correct way of making engines, may be applied with great advantage to circular instruments, for

for the purposes of astronomy and land-surveying. If the Society will do me the honor to appoint a Committee to view the engine itself, I will demonstrate its effects.

I am, Sir,
Your very humble Servant,
JAMES ALLAN,
Divider of Mathematical Instruments.

No. 12, *Blewit's Buildings,*
Fetter Lane, Nov. 20, 1809.

To C. Taylor, M. D. Sec.

Mr. Allan's Description of his Mathematical Dividing Engine, and his Method of forming it.

My engine is of bell-metal, thirty inches in diameter. I turned a brass ring about three-sixteenths of an inch thick, and fitted in on the underside of the above bell-metal wheel, which I made fast by twenty-four rivets; I then fixed in the axis, and turned the wheel and ring together on the lathe, as near as possible to the required shape on its own axis. This being done, and having mounted it on its own stand, where it now acts, I fixed a tool, with an adjustment to turn the edge of the bell-metal wheel where the uppermost or moveable ring of the same thickness as the other is fitted on; for if the circle, where the moveable ring fits the bell-metal, is not turned as true as possible, (which cannot be done properly by any other means than by a fixed tool) the moveable ring will not reverse correctly. When this was done, I fitted on the moveable ring. I then divided the lower under ring into twenty-four parts, for the screws which keep the rings together. I also divided it into four parts for the steady pins;

pins; the holes of which I made by an upright drill fixed and adjusted for the purpose. I then cut two opposite divisions, in order to reverse the uppermost ring correctly, which were my guide in broaching for my steady pins, and which I did with a broach to a stop fixed on it. In broaching I reversed the moveable ring many times, taking care at the same time that my opposite divisions were correct.

My first idea was to have two wheels or circles, acting on the same centre, so as to constitute a double edge, to afford me an opportunity to reverse in the act of cutting the rack or teeth; but I thought the method in which I have done it would with care be equally correct. Either of the methods come to the same point, and I preferred the way I have employed, thinking it the least expensive. By this self-correcting method, instruments may be made for astronomical purposes, racked and divided on their own centre, and if carefully done would border on perfection itself, consequently I consider it to be the greatest improvement ever made in the art of dividing. I call it self-correcting, because every time it is reversed in cutting the teeth, the screw has a fresh opportunity to correct errors insensible to the eye.

I have well considered the subject, and think that a circle of twelve inches diameter, made on this principle, would measure angles equally, if not more accurately than astronomical instruments divided by engines, or by any other methods hitherto used by instruments of any size. It is, therefore, my opinion, that the supposed necessity of making very large circles, for the sake of obtaining correct divisions, will be done away.

JAMES ALLAN.

CERTIFICATES.

CERTIFICATES.

After a close consideration of Mr. Allan's improvement in dividing engines, (I mean his mode of racking the teeth only) when combined with the methods at this time known and practised, I look upon it as an important discovery; it is a plan that in my opinion will admit of a great degree of accuracy, approaching nearly to perfection itself, particularly in circles of small radius, but not quite so applicable in large machines for the purpose of dividing.

JOHN STANCLIFFE.

Little Mary-le-Bone Street,
Dec. 15, 1809.

SIR,

THE method you have taken to produce a perfect equal racking, for the constructing an accurate dividing engine, is the greatest advance towards perfection that has been communicated to the public within my knowledge, and I believe it to be a method never before practised in this country. It is applicable to the construction of machines of any dimensions, that mathematical or nautical instruments can be graduated by.

It is my belief, that the greater number of the machines now in use, are far short of the perfection they are reputed to have.

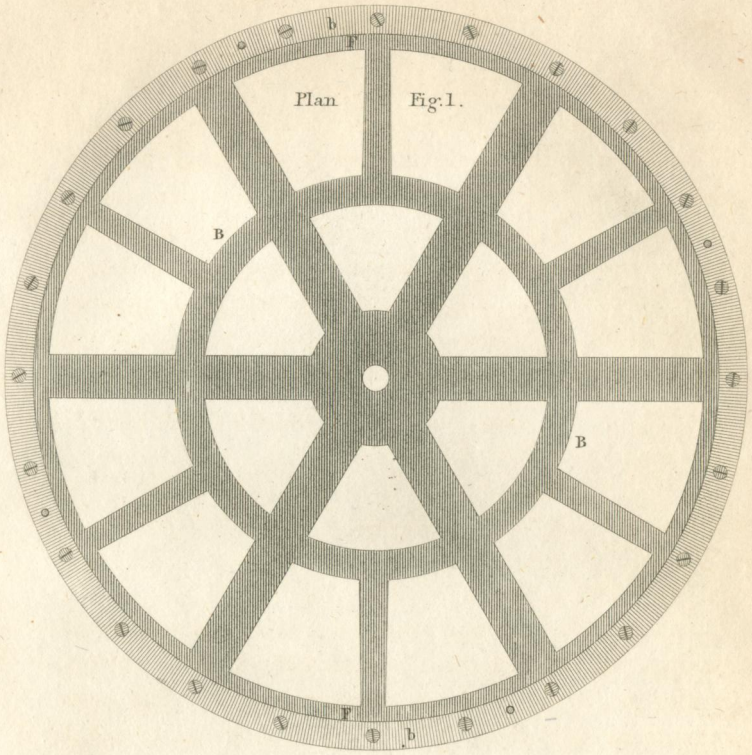
I am, Sir,

Your humble Servant,

M. BERGE.

Piccadilly, Jan. 8, 1810.
Mr. J. ALLAN.

Reference



Mr. Allan's Mathematical Dividing Engine.

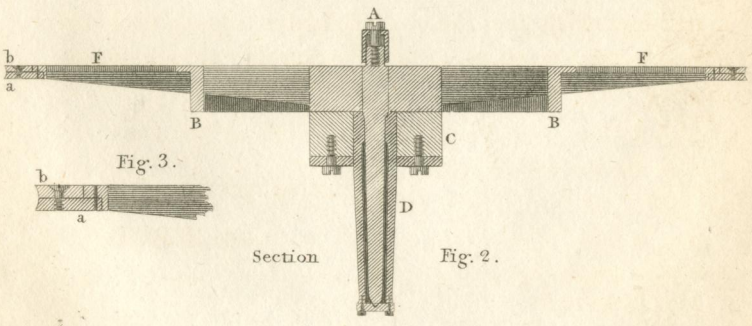
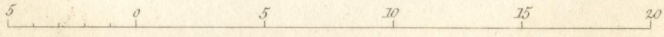


Fig. 3.

Section Fig. 2.



Scale of Inches.

Drawn by J. Farey Junr.

Engraved by S. Porter.

Reference to the Drawing of Mr. Allan's improvement on the Dividing Engine of Ramsden, Pl. 7.

The dividing engine invented by Mr. Jesse Ramsden, and for which he received the reward of the Board of Longitude, in the year 1775, is minutely explained in a quarto pamphlet, published by order of the Commissioners of Longitude; also, in the article *engine*, in Dr. Rees's New Cyclopædia, as well as some other works of a similar nature; it therefore becomes unnecessary for the Society to give any more of Mr. Allan's engine in their drawings than is explanatory of the improvement, the engine being used in the same manner as Ramsden's; this part is the great circle upon which the arch to be divided is placed, and the circle turned about a determinate quantity at each division, by means of a screw whose threads engage fine teeth, cut around the periphery of the circle. The improvement by Mr. Allan consists in the method of cutting or racking these teeth, to ensure their being perfectly of equal size, in all parts of the circle.

The plan, fig. 1. in plate 7, represents the upper surface of a bell-metal circle mounted upon an axis, A, fig. 2. and its surface made truly plane, and perpendicular to the axis; the section shews the figure of the axis, and the central ring B, to give the greatest strength to the circle; C is a section of a portion of the frame of the engine; and D a socket into which the axis A is fitted; the circumference of the large circle is turned to such a figure as to receive a ring of brass, *a*, fig. 3. which is united firmly to it by a number of pins, one of which is shewn in the figure. Upon this ring, a second *b* is placed, the two making the same thickness as the circle. The inside of the ring *b*, and the outside of the bell-metal

metal circle, are fitted to each other with the utmost accuracy, and great care taken to turn the said truly fitting concentric with the axis of the circle; the brass rings *a* and *b* are held together by twenty-four screws, as shewn in the plan; and a groove, corresponding to the curvature of the screw which moves the circle, is turned in the outside of the two; in this state the racking of the teeth is performed by a screw similar to that afterwards used to turn the circle to its divisions, but notched across the threads so that it cuts like a saw, when pressed against the circle and turned round, and removes the metal from the spaces between the teeth, which are by this means formed around the edge of the circle; when this has been performed all round, two fine lines are drawn across the brass and bell-metal circles, diametrically opposite each other; the twenty-four screws are then withdrawn, and the upper brass ring turned exactly half round, which is determined by the lines before-mentioned; and by this means the teeth of the circle are divided into two thicknesses, and being put together again in opposite directions, if any error arose in racking the teeth, it would be shewn by the upper and lower halves of the teeth, not coinciding when reversed, and by racking them while reversed the screw would cut away the inequalities, and make all the teeth of the same size and distance from each other; this reversing the teeth is performed several times, till the teeth are brought to a perfect equality in all parts of the circle; four steady pins are accurately fitted into the two rings to hold them together in any of the positions in which they have been racked together, and it is upon these the dependence is placed for the co-incidence of the teeth, the twenty-four screws being merely to hold them fast together, and fitted rather loosely in their holes, that they may not strain the steady pins.

The

The GOLD MEDAL *of the Society was this Session voted to Mr.* BRYAN DONKIN, *of Fort Place, Bermondsey, for an Instrument to ascertain the Velocities of Machinery, called by him a Tachometer. The following Communication was received from him. An explanatory Engraving is annexed, and a complete Machine and a Drawing is preserved in the Society's Repository.*

SIR,

I BEG leave, through your means, to lay before the Society of Arts, &c. an instrument of my invention, for indicating the velocity of machines, and which may not improperly be called a Tachometer. You will at the same time receive a drawing, with an account of the instrument, and the mode of its application.

I am, Sir, most respectfully,

Your obedient humble Servant,

BRYAN DONKIN.

Fort Place, Bermondsey,
April 11, 1810.

To C. TAYLOR, M. D. SEC.

Reference to, and Description of, Mr. Donkin's Tachometer, or Instrument for indicating the Velocity of Machinery, Pl. 8.

In the employment of machinery it is evidently of great importance to be provided with an easy and ready method for discovering at all times whether the motion of the machine is quicker or slower than what is known to be best adapted for the object in view. This advantage, it is hoped, may be derived from the Tachometer, for it is an instrument which requires only to be adjusted once for all, to any particular machine, and then it will always be ready without the help of calculation or of a time-piece, to indicate instantly upon inspection the slightest excess or defect in the actual velocity.

A front view of the Tachometer is represented in fig. 1, and a side view in fig. 2, of plate 8. X Y Z, fig. 1, is the vertical section of a wooden cup, made of box, which is drawn in elevation at X, fig. 2. The whiter parts of the section, in fig. 1, represent what is solid, and the dark parts what is hollow. This cup is filled with mercury up to the level L L, fig. 1. Into the mercury is immersed the lower part of the upright glass tube A B, which is filled with coloured spirits of wine, and open at both ends, so that some of the mercury in the cup enters at the lower orifice, and when every thing is at rest, supports a long column of spirits, as represented in the figure. The bottom of the cup is fastened by a screw to a short vertical spindle D, so that when the spindle is whirled round, the cup, (whose figure is a solid of revolution) revolves at the same time round its axis, which coincides with that of the spindle.

In consequence of this rotation, the mercury in the cup acquires a centrifugal force, by which its particles are thrown outwards,

outwards, and that with the greater intensity, according as they are more distant from the axis, and according as the angular velocity is greater. Hence, on account of its fluidity, the mercury rises higher and higher as it recedes from the axis, and consequently sinks in the middle of the cup; this elevation at the sides and consequent depression in the middle increasing always with the velocity of rotation. Now the mercury in the tube, though it does not revolve with the cup, cannot continue higher than the mercury immediately surrounding it, nor indeed so high, on account of the superincumbent column of spirits. Thus the mercury in the tube will sink, and consequently the spirits also; but as that part of the tube which is within the cup is much wider than the part above it, the depression of the spirits will be much greater than that of the mercury, being in the same proportion in which the square of the larger diameter exceeds the square of the smaller.

Let us now suppose, that by means of a cord passing round a small pulley F, and the wheel G, or H, or in any other convenient way; the spindle D is connected with the machine whose velocity is to be ascertained. In forming this connection, we must be careful to arrange matters so, that when the machine is moving at its quickest rate, the angular velocity of the cup shall not be so great as to depress the spirits below C into the wider part of the tube. We are also, as in the figure, to have a scale of inches and tenths applied to A C, the upper and narrower part of the tube, the numeration being carried downwards from zero, which is to be placed at the point to which the column of spirits rises when the cup is at rest.

Then the instrument will be adjusted, if we mark on the scale the point to which the column of spirits is depressed, when the machine is moving with the velocity required.

But, as in many cases, and particularly in steam-engines, there is a continued oscillation of velocity, in those cases we have to note the two points between which the column oscillates during the most advantageous movement of the machine.

Here it is proper to observe, that the height of the column of spirits will vary with the temperature, when other circumstances are the same. On this account the scale ought to be moveable, so that by slipping it upwards or downwards, the zero may be placed at the point to which the column reaches when the cup is at rest; and thus the instrument may be adjusted to the particular temperature with the utmost facility, and with sufficient precision. The essential parts of the Tachometer have now been mentioned, as well as the method of adjustment; but certain circumstances remain to be stated.

The form of the cup is adapted to render a smaller quantity of mercury sufficient, than what must have been employed either with a cylindrical or hemispherical vessel. In every case two precautions are necessary to be observed:—First, That when the cup is revolving with its greatest velocity, the mercury in the middle shall not sink so low as to allow any of the spirits in the tube to escape from the lower orifice, and that the mercury, when most distant from the axis, shall not be thrown out of the cup. Secondly, That when the cup is at rest, the mercury shall rise so high above the lower end of the tube, that it may support a column of spirits of the proper length.

Now in order that the quantity of mercury, consistent with these conditions, may be reduced to its minimum, it is necessary—first, that if M M, fig. 1, is the level of the mercury at the axis when the cup is revolving with the greatest velocity, the upper part M M X Y of the cup should be of such

Mr. Donkin's Tachometer.

Fig. 1.

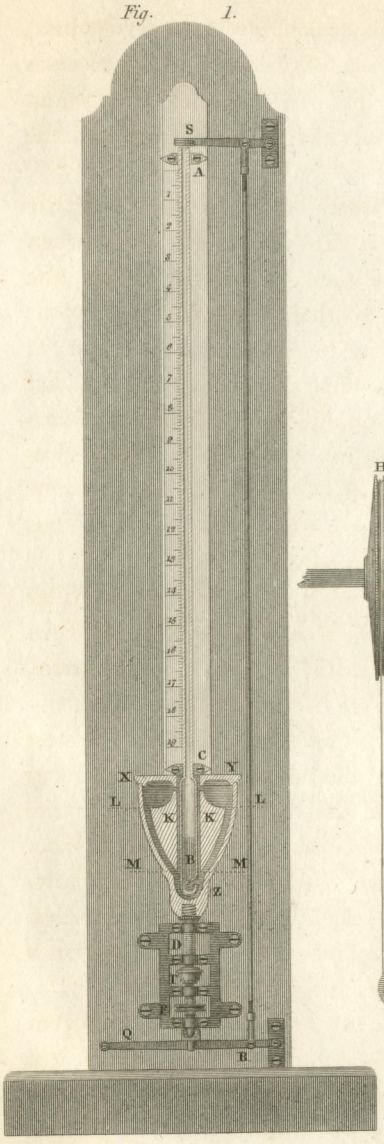


Fig. 2.

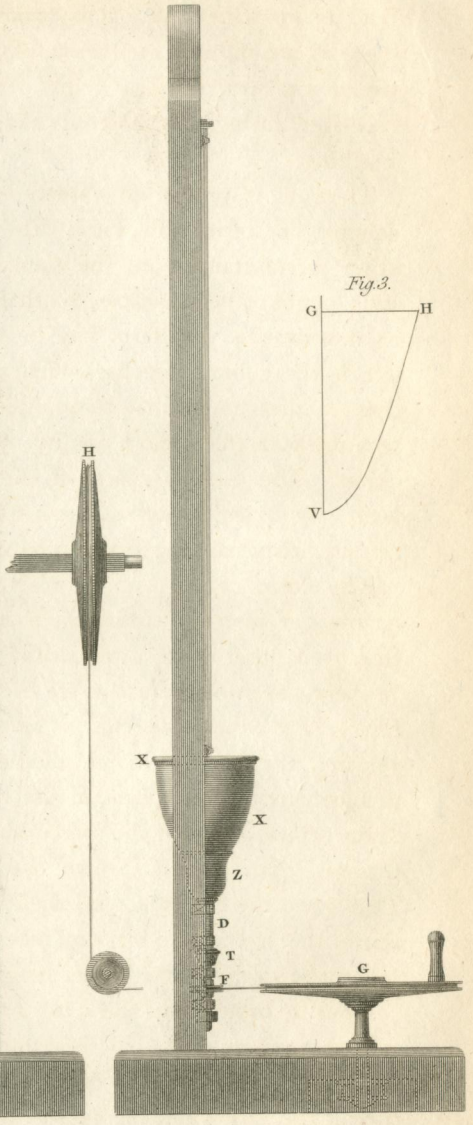


Fig.3.

Drawn by J.Farey Jun.r

Engraved by S.Porter.

such a form as to have the sides covered only with a thin film of the fluid; and secondly, that for the purpose of raising the small quantity of mercury to the level L L, which may support a proper height of spirits when the cup is at rest; the cavity of the cup should be in a great measure occupied by the block K K, having a cylindrical perforation in the middle of it for the immersion of the tube, and leaving sufficient room within and around it for the mercury to move freely both along the sides of the tube and of the vessel.

The block K K is preserved in its proper position in the cup or vessel X Y Z, by means of three narrow projecting slips or ribs placed at equal distances round it, and is kept from rising or floating upon the mercury by two or three small iron or steel pins inserted into the underside of the cover, near the aperture through which the tube passes.

It would be extremely difficult, however, nor is it by any means important, to give to the cup the exact form which would reduce the quantity of mercury to its minimum; but we shall have a sufficient approximation, which may be executed with great precision, if the part of the cup above M M is made a parabolic conoid, the vertex of the generating parabola being at that point of the axis to which the mercury sinks at its lowest depression, and the dimensions of the parabola being determined in the following manner:— Let V G, fig. 3, represent the axis of the cup, and V the point, to which the mercury sinks at its lowest depression; at any point G above V, draw G H perpendicular to V G; let n be the number of revolutions which the cup is to perform in 1″ at its quickest motion; let v be the number of inches which a body would describe uniformly in 1″, with the velocity acquired in falling from rest, through a height = to G V, and make G H = $\frac{v}{3\ 14\ n}$. Then, the parabola

to be determined is that which has *v* for its vertex, V G for its axis, and G H for its ordinate at G. The cup has a lid to prevent the mercury from being thrown out of it, an event which would take place with a very moderate velocity of rotation, unless the sides were raised to an inconvenient height; but the lid, by obstructing the elevation at the sides of the cup, will diminish the depression in the middle, and consequently the depression of spirits in the tube: on this account a cavity is formed in the block immediately above the level L L, where the mercury stands when the cup is at rest; and thus a receptacle is given to the fluid which would otherwise disturb the centrifugal force, and impair the sensibility of the instrument.

It will be observed, that the lower orifice of the tube is turned upwards. By this means, after the tube has been filled with spirits by suction, and its upper orifice stopped with the finger, it may easily be conveyed to the cup and immersed in the quicksilver without any danger of the spirits escaping, a circumstance which otherwise it would be extremely difficult to prevent, since no part of the tube can be made capillary, consistently with that free passage to the fluids, which is essentially necessary to the operation of the instrument.

We have next to attend to the method of putting the Tachometer in motion whenever we wish to examine the velocity of the machine. The pulley F, which is continually whirling during the motion of the machine, has no connection whatever with the cup, so long as the lever Q R is left to itself. But when this lever is raised, the hollow cone T, which is attached to the pulley and whirls along with it, is also raised, and embracing a solid cone on the spindle of the cup, communicates the rotation by friction. When our observation

servation is made, we have only to allow the lever to drop by its own weight, and the two cones will be disengaged, and the cup remain at rest.

The lever Q R is connected by a vertical rod to another lever S, having, at the extremity S a valve, which, when the lever Q R is raised, and the Tachometer is in motion, is lifted up from the top of the tube, so as to admit the external air upon the depression of the spirits; on the other hand, when the lever Q R falls, and the cup is at rest; the valve at S closes the tube and prevents the spirits from being wasted by evaporation.

It is lastly to be remarked, that both the sensibility and the range of the instrument may be infinitely increased; for, on the one hand, by enlarging the proportion between the diameters of the wide and narrow parts of the tube, we enlarge in a much higher proportion the extent of scale corresponding to any given variation of velocity; and on the other hand, by deepening the cup so as to admit when it is at rest a greater height of mercury above the lower end of the tube, we lengthen the column of spirits which the mercury can support, and consequently enlarge the velocity, which, with any given sensibility of the instrument, is requisite to depress the spirits to the bottom of the scale. Hence the Tachometer is capable of being employed in very delicate philosophical experiments, more especially as a scale might be applied to it, indicating equal increments of velocity. But in the present account it is merely intended to state how it may be adapted to detect in machinery every deviation from the most advantageous movement.

THIRTY GUINEAS *were this Session voted to Mr.* LEWIS AUBREY, *of Fort-place, Bermondsey, for Implements for equalizing the Width and Thickness of Leather Straps. The following Communication was received from him. An Explanatory Engraving is annexed, and the Implements are preserved in the Society's Repository.*

GENTLEMEN,

HAVING contrived two implements for equalizing the breadth and thickness of leather straps, which will be found of the greatest utility to sadlers, harness and collar-makers, leather-cutters, and others, I take the liberty most respectfully to offer them to you, hoping they will be found to merit your approbation and reward, which will be most grateful to,

Gentlemen,

Your most obedient humble Servant,

LEWIS AUBREY.

Fort place, Bermondsey,
Nov. 22, 1809.

To the Society of Arts, &c.

CERTIFICATES were received from the following persons, addressed to Mr. Aubrey, dated in March last.

From Mr. W. B. BROWN, of Two Waters Mill, stating that it is with much pleasure he has it in his power to bear full testimony

testimony to the superiority of the deakle straps cut by his process, as they combine those indispensable qualities of regularity in thickness and breadth, so particularly requisite for their purpose.

From Mr. JOHN BUTTONSHAW, of West Peckham, Kent, stating, that the deakle-straps and wire-straps used in his machine for manufacturing paper, are made perfectly smooth and true, and much superior to any he can get made either at the shoe or collar-makers, or any other workers of leather, and that he buys them of Mr. Donkin, Fort-place, Bermondsey.

From Mr. JAMES SWANN, of Ensham-mills, near Oxford, stating, that in answer to Mr. Aubrey's letter, he can readily certify, that the straps lately supplied by Mr. Donkin, and which are made with tools of Mr. Aubrey's invention, are found to be superior in point of evenness, width, and thickness, to any he ever procured before, and which have induced him a few days ago to order a further supply of them.

From Mr. RICHARD ELLIOT, of Chesham, stating, that at Mr. Aubrey's request, he would say what he knew from practice, respecting the leather cut by his machine; that they are the best he ever had, and are cut as correct as possible, both in thickness and width, and answer much better than any cut in the common way.

Reference to the Engraving of Mr. Aubrey's Machines for cutting Leather Straps, Plate 9.

Figs. 1, 2, and 3, are a plan, section, and end-view of the instrument for cutting leather-straps to an equal thickness. A is the knife fixed to the frame by two screws *a a*, which pass

pass through holes in the end of the knife, and have two nuts upon each of them, between which is fastened the knife, and by means of these the knife can be raised or lowered, and fixed at any point, by screwing the nuts towards each other: *b*, fig. 3, is the lower, and *c* the upper one, which fastens the knife upon the other; the screws *a a* are fastened to the frame by two plates and four screws at *d*, *d*, *d*, *d*, which fit into oblong holes in the plates, and can be loosened to put the knife nearer to, or further from a roller B, between which, and another roller D, fig. 2, (concealed in the wooden frame,) the leather-strap passes; the bearing *e e* for the pivots of the upper roller are screws, and received into tubes E, E, figs. 1, 2, and 3, which are also screwed internally, so that, by turning these tubes round, the roller is brought nearer to, or further from the roller D, to suit straps of different thicknesses; the tubes are also drawn down by helical-springs (concealed in the wood,) which keep the upper roller down with a moderate pressure, but at the same time allow it to rise up, if a thick part of the strap comes under it. F F are two handles fixed to the mahogany-block, which is the frame for the whole. G is a rod or wire bent at right-angles at each end, and driven into the block with two sliding pieces *g g* upon it, which can be fixed at any distance from each other by screws; these are set to the width of the strap, to keep it parallel in passing through the rollers B and D; it enters in between them, passing under the knife A, and over the inclined part *h*, fig. 2, the end which is just through is fastened to the work bench, and the workman takes the machine by its handles F F, and draws it back from the bench, this pulls the strap through between the rollers, and the knife removes all the leather which projects above its edge, leaving the strap of a perfectly equal thickness throughout; this thickness is,

as

Mr. Aubreys Instruments for cutting Leather Straps.

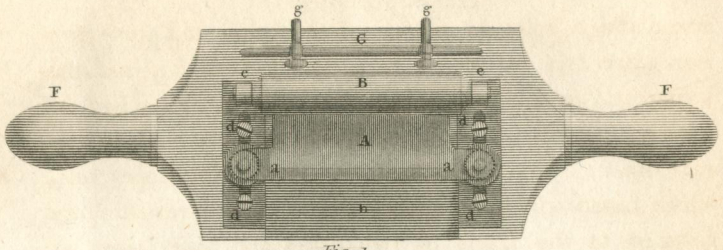


Fig. 1.

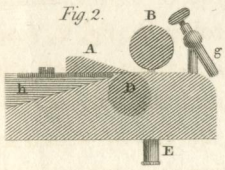


Fig. 2.

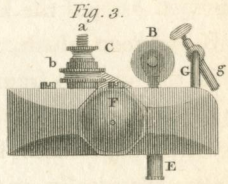
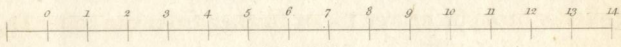


Fig. 3.



Scale of Inches.

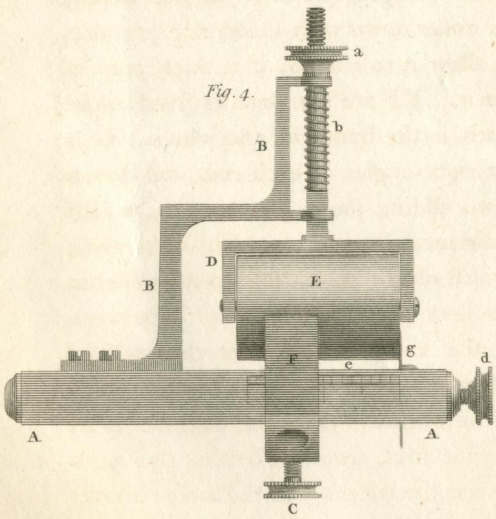


Fig. 4.

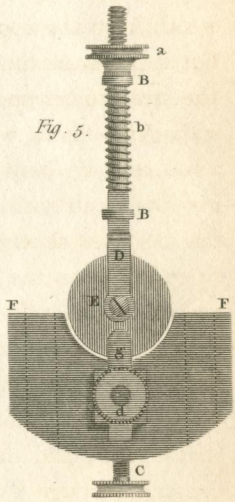
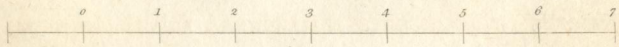


Fig. 5.



Inches.

Drawn by Farey, Jun.r

Engraved by S. Porter.

as above-mentioned, regulated by the distance; the knife edge is placed above the roller D: in cutting the strap the smoothest side is placed downwards upon the lower roller. Figs. 4 and 5, are elevations of the other machine, for cutting the strap to an equal width throughout. A A is a brass bar made hollow, for lightness; B B an iron frame screwed to it, and supporting a frame D containing a roller E; the frame D slides up and down in the other by a screw and nut *a*, but it has a constant tendency towards the bar A by means of a spring *b*, which surrounds the screw, and counteracts the pressure of the nut *a*; F is a piece of the brass sliding upon the bar A, and can be fixed at any part of it by the screw C, it has a semicircular gap cut in it to admit the roller E, as shewn in fig. 5: *g* is a small and thin sharp-edged knife, put through the end of the bar A, and held in its place by a screw *d*; this knife is placed exactly at the end of the roller, as seen in fig. 4. The strap to be cut is passed through the opening *e*, fig 4, and the roller suffered to descend by its nut *a* until the spring presses the roller down upon the strap, with sufficient force to keep it steady; the piece F is fixed along the bar, at the same distance from the knife, as the strap is intended to be wide; and this is shewn by the divisions on the bar, the strap being then drawn through under the roller, the knife cuts away all parts which are beyond its edge, and reduces the strap to the proper breadth.

TWENTY GUINEAS *were this Session voted to Mr.* CHARLES WILLIAMS, *of No. 3, Cane Place, Gravel Lane, Southwark, for a Method of boring the conical part of Brass Cocks. The following Communication was received from him. An Explanatory Engraving is annexed, and a Drawing of the Machinery is preserved in the Society's Repository.*

SIR,

HAVING been for some time engaged in the business of making large brass cocks, for drawing off liquors, I found a very great inconvenience in boring the conical part, especially with the water-way cast in them. This circumstance suggested to me the necessity of a method of manufacturing them with more facility than had hitherto been practised.

Permit me to lay before the Society an apparatus for boring such cones with as much ease and accuracy, as cylindrical bores of any calibre, in a correct, simple, and handy manner. At any time it can be introduced to a common lathe, with little loss of time, and be worked by an ignorant person. Finding, by continual experience, this advantage to be important, I communicate it to the Society, in hopes, that by their generous encouragement, it may prove beneficial to trade in general.

I am, Sir,

Your obedient Servant,

CHARLES WILLIAMS.

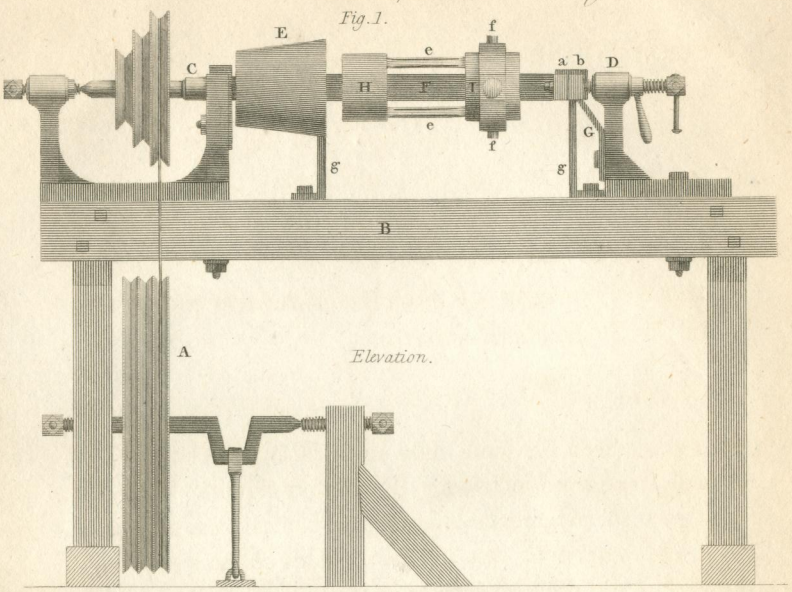
No. 3, Cane Place, Gravel Lane, Southwark, Jan. 5, 1810.

To C. TAYLOR, M. D. SEC.

Reference

Mr. Williams Machine for boring brass Cones.

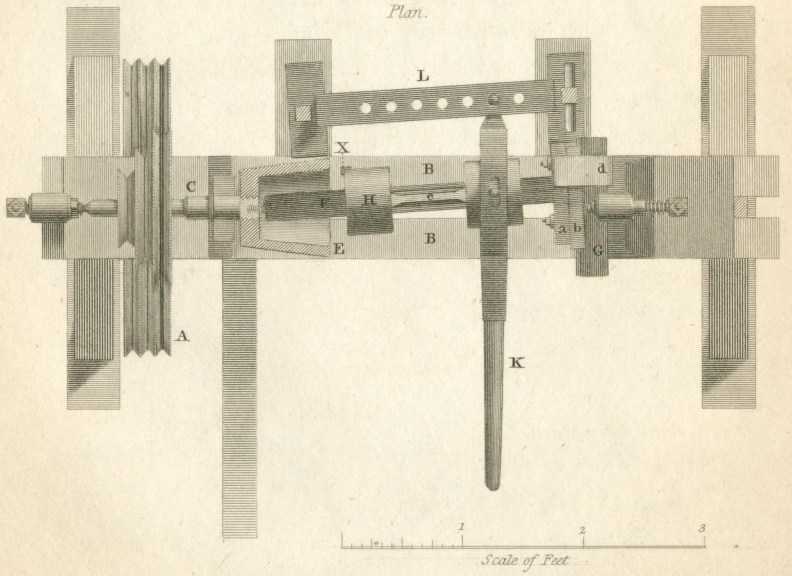
Fig. 1.



Elevation.

Fig. 2.

Plan.



Scale of Feet

Drawn by J. Farey, Junr.

Engraved by S. Porter.

Reference to the Engraving of Mr. Williams's Machine for boring Brass Cones, represented in Plate 10.

This apparatus is adapted to be fitted to any common turning lathe, with a few trifling additions: A, figs. 1 and 2 in the plate, is the foot-wheel of the lathe; B, the cheeks, C the mandrel, and D the front-puppet; the piece of work in which the conical aperture is to be bored, E, is fixed on a screw at the end of the mandrel, so as to revolve with it in the usual manner of turning; a small pin is screwed into the end of the mandrel, as shewn in the plan, fig. 2, which has a spherical head, and is received into a suitable cavity in the end of a square iron bar F, which is of sufficient length to extend to the front-puppet D; at this end it has a sort of crutch or cross head *a*, *b*, composed of two pieces lying parallel to each other, and united by two screw-bolts, which being fitted into oblong holes, admit a small lateral motion of the piece *b*, by the side of *a*; but they can be firmly held together by drawing the bolts tight; the piece *a* is formed from the same piece of steel as the bar F; and the other, *b*, has several holes bored in the far side of it, to receive the point of the screw of the front puppet D; these holes are at equal distances from each other, so that by introducing the screw in one or other of them, the bar F can be inclined to the axis of the mandrel, and by releasing the screws which unite *a* and *b*, a finer adjustment can be made of the intermediate spaces between the holes, so as to incline the bar F, in any angle within the limits of the length of the cross *a b*: the bar is supported by an iron frame G, screwed to the front puppet, and it is kept from rising by an iron clamp *d*, attached to G, and extending over *a*, *b*, it at the same time serves as an index to divisions upon *a*, which determines the angle of F and C.

Upon

Upon the bar F, two cylindrical sliders, H and I, are fitted to slide as freely and accurately as possible; the former is provided with a steel-cutter or tooth X, projecting a small quantity from its circumference, and it is this which performs the cutting or boring within the cone E, fixed to the end of the mandrel; the cutter slider H, is connected with the slider L, by two iron rods *e*, *e*, and I is moved along the bar by a lever K, which has a large opening or eye through it, to admit the slider I, and takes its bearing against two pins *f f*, fixed in the slider, and passing through holes in the lever; the lever is supported by an iron plate L, fig. 2, having several holes to receive a short pin projecting upwards from the end of the lever. The plate L is supported by two legs, *g g*, fig. 1, which are bolted to two wooden blocks projecting from the far side of the cheeks B; one of these bolts (see fig. 2) is passed through an oblong hole in the leg, so that the plate L can be moved backwards and forwards to be always parallel to the bar F. The manner of rising this machine scarcely needs any explanation, the work being put together as above described, and with a cutter X adapted to the size of the cone to be bored; the workman hooks the pin at the end of the lever K into any of the holes in the plate L, and by this means gains a power to thrust the cutter forwards into the cone, by pressing the end of the lever towards the mandrel, which is at the same time revolving with the work to be bored or turned out to a true cone by the cutter X; and it is evident that any number of cones which are afterwards to be turned by the same means, will be precisely of the same size and angle.

The SILVER MEDAL *of the Society was this Session voted to Mr.* EZEKIEL BAKER, *No.* 24, *Whitechapel-road, for a Method of rendering Fire-Arms, more safe to the Bearer, and more effectual in use. The following Communication was received from him. An Explanatory Engraving is annexed, and a Pistol on this construction is preserved in the Society's Repository.*

SIR,

I BEG leave to send, for the inspection of the Society of Arts, &c. some improvements which I have, at different times, made in the construction of fire-arms, some of which will be found useful to gentlemen, sportsmen, and others, very serviceable in war, and already adopted by Government. I am therefore desirous to claim the merit of the inventions, and am willing they should be published for the public benefit.

For this purpose I have sent a description of the different improvements, and a pistol made conformably thereto; and I will with pleasure furnish any additional information that may be required by the Society.

I remain, Sir,

Your most obedient Servant,

EZEKIEL BAKER.

No. 24, *Whitechapel-road, Feb.* 22, 1810.

To C. TAYLOR, M. D. SEC.

The

The following CERTIFICATES *were received.*

From Lieutenant-Colonel B. BLOOMFIELD, of the Royal Horse-Artillery, stating, that he has inspected four of Mr. Baker's cavalry pistols, and considers them to possess superior advantages over those now in use, especially in their priming themselves, as this new method prevents waste of powder, and the uncertainty of the operation of loading on horseback, and is not so liable to damage in wet weather.

That he likewise considers the long hammer an improvement, as it prevents the pistol from cocking itself in the act of putting it into the holster. It also gives facility to the opening of the pan, in which operation, with the usual lock, the soldier often wounds himself with the flint.

From Lieutenant THOMAS SMITH, of the Seventh regiment Veteran Battalion, late Quarter-Master in the Royal Regiment of Horse-Guards, Blue; also from Lieutenant THOMAS SHEILS, of the Seventh Royal Veteran Battalion, Tower, formerly Serjeant in the Royal Veteran Battalion Dragoons; stating, that they have examined the pistol made by Mr. E. Baker, and are of opinion it is on the best principle that can be adopted for cavalry, by the improvement of the rammer, raised hammer, and a touch-hole to prime itself; and that from their long services on the Continent, they have frequently experienced the evil, noticed by Mr. Baker, in the common pistol.

From Lieutenant-Colonel OTWAY, of the Eighteenth Light Dragoons, stating, that Mr. Baker had showed him his pistol, and that he thinks to ensure its adoption in the cavalry it only requires that its merits should be made known.

known. That the swivel-rammer is now pretty generally in use; and it would, in his opinion, be extremely advantageous were pistols generally constructed to prime themselves.

That he is a warm advocate for the long hammer, knowing, by experience, how frequently the common pistol is forced to the full-cock in returning it to the holster-pipe; and that he once witnessed, from an accident of this nature, the most fatal consequences to a dragoon from its unexpected explosion.

From Lieutenant Colonel G. QUINTIN, of the Tenth Light Dragoons, stating, that he had minutely inspected a new pattern pistol with a swivel-rammer, which primes itself, the property of Mr. Baker, and finds that it answers the desired purpose in every respect.

A Description of several Improvements on Fire-Arms made by Mr. Ezekiel Baker.

First, The lock bolts itself in going into half-cock, by means of a small spring and lever behind the bolt, lying across the plate. The lever is pressed against the bolt by means of a spring, which is always pressing against it at the end of the bolt-spring, which lies on the sear-spring; there is a part which projects from it below the bottom of the spring with a piece at the end of the sear; as the lock is taken to half-cock by the round part of the tumbler, the sear is thrown up at that end, which lifts up the bolt-spring over the bolt; the cross-spring and lever then passing against the bolt, forces it into the notch of the tumbler,

which holds the cock fast, so that it cannot go to the cock until unbolted; this way of bolting will prevent many accidents which might have happened. In the present way of bolting, the bolt must be forced forwards with the thumb or finger into the tumbler; this is frequently forgot to be done, the person, in loading, thinking himself secure from danger of his piece going off, by means of the bolt when loaded, takes up his piece, thinking to unbolt and cock it, to his great surprise he finds it on full-cock, and he is himself exposed to great danger. This I have often done myself, for which reason I have made this improvement, which will be found useful, particularly so in rifle-guns and pistols, or any other fire-arms where a bolt is required.

Secondly, The hammer of the lock is raised towards the cock, which will prevent it from catching the top of the holster in putting in the pistol. Instances have been known that the pistol by that means has gone off, and both man and horse have been wounded. The hammer, raised in this manner, will also be found useful in soldiers' musket-locks, as it will prevent the thumb from being cut with the flint, which is frequently done in throwing the hammer back, as the springs are in general very strong, and the purchase is small, particularly with a new flint.

Thirdly, Locks in general throw the fire over the pan, which is of no use whatever; the fence here added under the hammer is a preventive; it moves with the hammer, and returns the fire into the pan, makes it more certain of firing, will prevent the oil from drying up, and the powder from clogging the joint of the hammer, and the pan being inclined towards the fence shortens the hammer face, and admits the fire quicker into the prime in the pan; the pan being grooved or raised as this is, would be found very

useful

useful in musket-locks: in the present way they are left flat, and after firing a few rounds the filth of the powder is collected against the fence, so that the hammer cannot joint down on the pan, which will admit wet or damp air into the prime, and which is a great hinderance to its firing; and sometimes the priming is also lost out of the pan; this I have often seen.

Fourthly, The screw of the lock being moved farther back from the breech of the barrel, will be a remedy against so many screws breaking, which hold in the locks, and the stocks from being split on the backside, both of which are great evils.

Fifthly, The rammer being swivelled will be found advantageous to cavalry, as the men cannot lose them, which is often done in the present way; besides they ram the charge home more certainly and quicker. The rammer might be left in the barrel when loaded with ball-cartridge, and it will keep the ball in its proper place. In the present mode of loading, from the motion of the horse, the ball is so shook, that it becomes loose in the barrel, and is even frequently left in the holster, so that when the pistol is taken out to be fired, it has not the effect that it would have had, had the ball been in its proper place. In taking the pistol out of the holster to present, the rammer will fall out of the way of the ball when fired, should there not be time to return the rammer into its proper place, and when fired both may be put into the holster together without any difficulty. The touch-hole being made wide to prime itself will be found of great utility to cavalry. In the present way of priming and loading on horseback, owing to the wind blowing, and the motion of the horse, great part of the powder is scattered before it is put into the barrel; and owing to the right quantity of powder not being put

in the barrel, and its bad ramming, the pistol is of little use when fired. It might be advanced, that great part of the force of the powder would be lost, by having the wide touch-hole; but the whole charge being now put into the barrel will make up that deficiency, and the same quantity will be at all times alike in the barrel. It may be loaded also in the night if required, which, in the present mode would be found very difficult to effect. The two holes in the lock-plate, one under the main-spring, the other over the hammer-spring, with an iron pin or nail put into them, will keep off the pressure of the springs, whilst the work is taken off to be cleaned and put on again, as the springs do not require to be taken off every time the work wants cleaning and oiling, which cannot be done until the springs are taken off in the present way of cleaning, and which is performed by means of cramps of various sorts, by which the springs are frequently set or broke: in the way above described, they will not be liable to either injury.

Reference to the Drawing of Mr. Baker's improved Pistol Plate, Pl. II.

Fig. 1, is a profile of the whole taken together, in which the parts which are common to all pistols are too evident to need enumeration:—To proceed, therefore, to the improvement; A A is the ram-rod sliding through a ring *a*; see also fig. 2, which is pivoted into a forked-piece B, jointed to the barrel at C: the swivel has an universal motion, so that the ram-rod can be put by into its socket D, or put down into the barrel;

Mr. Baker's improved Pistol.

Fig. 1.

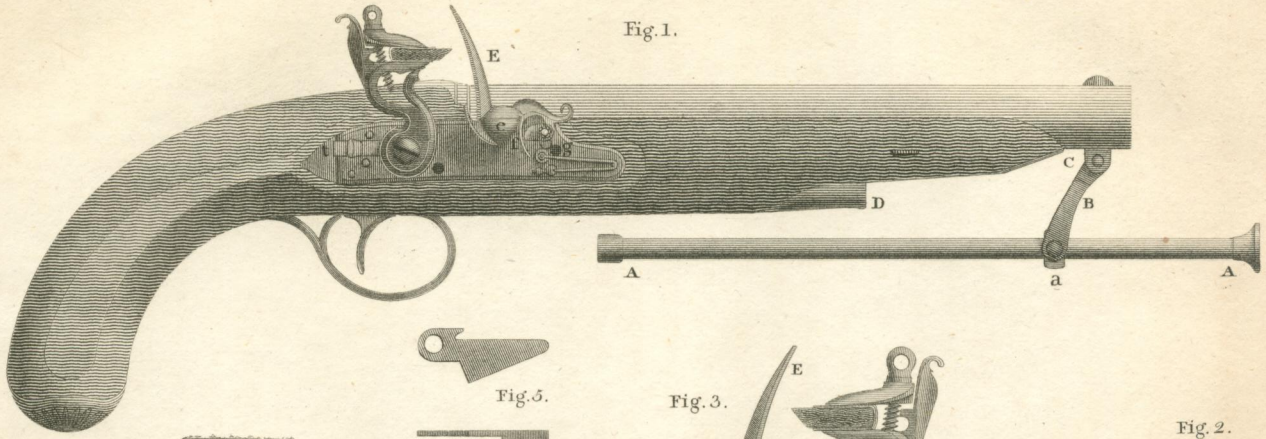


Fig. 5.

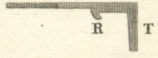


Fig. 4.

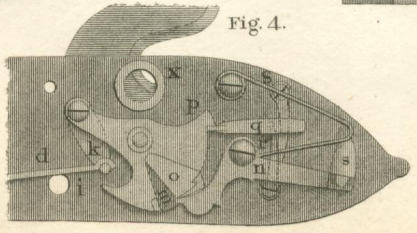


Fig. 3.

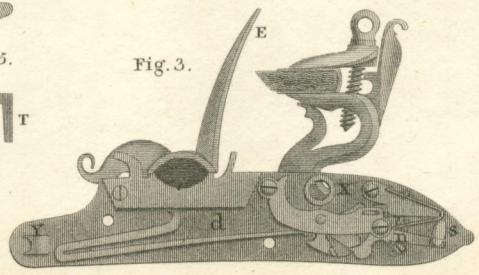
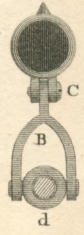


Fig. 2.



Drawn by J. Farey Junr.

Engraved by S. Porter.

barrel; the fork B in that case being turned over the muzzle, and the ring *a* coming exactly into the centre thereof. E is the hammer raised towards the cock for the reasons pointed out in Mr. Baker's paper: *e* is the pan to which the hammer fits down very closely; and *f* is a projecting piece of the hammer formed to a circle from the centre of the hammer-joint; this fence encloses the joint and spring, and keeps the powder and fire from them: *g* is the hammer-spring, with a roller at the end, which acts upon the hammer. The interior of the lock is shewn in the other figures: *d*, fig. 4. is the main-spring; and *i*, fig. 4. is the hole to receive a nail, or iron pin, to stay the spring while the lock is taken to pieces: *k* is the connecting iron, which communicates the power of the spring to the tumbler: *m* is the notch in the tumbler, into which the sear *n* is received when at half-cock; the notch for full-cock is dotted under *o*, in the position of fig. 4. the lock is prevented from firing by the form of the notch *m*, in the usual manner of half-cock; and the cock is prevented from being drawn further back by the tooth *p* of the tumbler, which is caught by the bolt *q*, pressed forwards by the spring and lever *r*, situated beneath the sear and its spring S; before the cock can be set at full-cock the bolt must be withdrawn by its tail *t*, fig. 1.; and it is then retained by a spring-catch, fig 5. screwed over the sear-spring, as in fig 3.; its tooth R catches a notch in the bolt when drawn back, and holds it; the cock is now at liberty to be set full, and fired in the usual way; when this happens the inclined wedge *s* of the sear is thrust under the part T, fig. 5, of the spring-catch, and raises it up; this relieves the bolt *q* from the tooth R, and is advanced towards the tumbler by its spring *r*, ready to prevent the lock being full-cocked without the bolt *t*, fig 1. is first withdrawn: *o* is a loose piece fitted to move upon a centre in the tumbler; its

use is, when at full-cock, to cover the notch *m* for half-cock, and prevent the sear *m* catching therein when fired, for it is adapted to bear off the point of the sear; by the inclined form of its end it readily slips out of the way when the cock is drawn back to set either to half or full-cock: X, figs. 3 and 4, is the hole for the screw which goes through the stock to fasten the lock; the other end of the lock is held in by a hook Y, fastened to the plate which catches under the head of a screw, screwed into the stock withinside the lock; this screw needs not be touched to take off the lock, as it readily unhooks, when the screw at X is removed.

FIVE GUINEAS *were this Session voted to Mr.* J. D. ROSS, *Princes Street, Soho, for his Invention of a Machine for separating Iron Filings from their Mixture with other Metals. The following Communication was received from him. An explanatory Engraving is annexed, and a complete Model is preserved in the Society's Repository.*

SIR,

I HOPE you will be pleased to lay before the gentlemen of the Society of Arts, &c. the model of a machine which I have invented to separate iron-filings, turnings, &c. from those of brass or finer metals, in place of the slow and tedious process hitherto employed, which is by a common magnet held in the hand. By my invention many magnets may now be employed

employed at once, combined and attached to a machine on a large scale. The magnetic hammers are so contrived as to take up the iron-filings from the mixture of them with other filings, or metallic particles, placed in the trays or end-boxes, and drop them into the receiving-box in the centre, which is effected by the alternate motion of a winch-handle, working the two magnetic hammers placed at two angles of a quadrant or anchor. In proportion to the power of the magnets and to the force of the blow given by the hammers, a great quantity of iron is separated from the brass, by the alternate motion, and dropped into the receiver placed in the centre of the machine.

I have showed the model to persons engaged in various metallic works, who give me great encouragement by their signatures and sanction, and I hope it will meet with the Society's approbation.

I am, Sir,

Your most obedient and humble Servant,

J. D. ROSS.

55, *Princes-street, Leicester-square,*
April 12, 1810.

To C. TAYLOR, M. D. SEC.

The following persons certified that they consider Mr. Ross's invention of a machine for separating iron-filings, turnings, &c. from those of brass or finer metals, as likely to prove extremely useful in various branches of workers in metal.

THOMAS CHARLES KING, Founder and Plater, No. 10, Brownlow-street;

CALVERT and DOWEY, Hart-street, Covent-garden;

WILLIAM SHAWLER, Litchfield-street;
J. ASQUITH, Metal Turner, St. Martin's-lane;
CHARLES BOND, Old Compton-street, Soho;
JOHN TURMEAU, Goldsmith, Carleton-place;
J. PERIGAL, Watch Maker, 55, Princes-street, Soho;
GEORGE HALL, Gold Worker, 482, Strand;
P. STORR, Silversmith, Dean-street, Soho;
H. HALL, Coach Plater, 5, Cross-lane, Long Acre;
W. WILLIAMS and SON, Button Makers and Silversmiths, 103, St. Martin's-lane.

Reference to the Drawing of Mr. Ross's Machine for separating Iron Filings from those of Brass, or other Metals, Fig. 1 *and* 2, *Pl.* 12.

A is an axis of brass, and B a handle upon the end of it; C is a piece of brass in form of an anchor, at each end of which a horse-shoe magnet is fixed, in the manner shewn at fig. 1, where *c* is the arch of the anchor, and *d* a piece of brass having a hole through it to receive the legs *e e* of the magnet, which is fixed to the arch by a screw *f*, tapped into the arch. The anchor is mounted upon the pivots of the axis A, in a frame E, which incloses it; on the outside of the frame two blocks of wood FF are situated, in each of which a hollow or tray is formed to receive the filings which are to be separated from the iron they contain in these hollows. The magnets fixed at the ends of the anchor strike upon the filings, and select, by the magnetic attraction, all the iron among them; the anchor is then turned over by the handle B, and the opposite magnet strikes in the other hollow F, at this time the other magnet is just over the axis, and by the

the jerk of its opposite striking the block F, the iron-filings are shook off and fall down in the bottom of the frame, or receiver; in this manner the handle B, being moved backwards and forwards, strikes the magnets alternately in the two blocks F, at the same time that one strikes, the opposite is cleared from the iron it has picked up by the shock; G is a screen of thin board to prevent the filings being scattered.

FIFTEEN GUINEAS *were this Session voted to Mr.* G. MARSHALL, *No.* 15, *Cecil Court, St. Martin's Lane, for constructing Sash Windows, so as to be cleaned or repaired without the necessity of any Person going on the outside of the House. The following Communication was received from him. An explanatory Engraving is annexed, and a Sash Frame made upon this plan is preserved in the Society's Repository.*

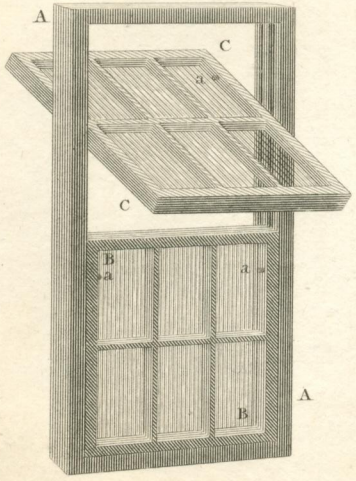
SIR,

IN consequence of the numerous accidents which occur from cleaning and painting the outside of windows, I beg leave to submit to the inspection of the Society a model of a sash-window, which if it meets their approbation and becomes generally adopted will, I think, save the life of many a fellow-creature, because the present mode of cleaning or painting the outside of windows is generally done by persons leaning out of the window, or getting upon a plank, or

or some other convenience made for the purpose, and projecting on the outside of the house; hence, from carelessness and inattention, many fatal accidents have occurred, and the services of many persons lost to their families and the public. One instance of this kind happened about three weeks ago to a man who was standing on a board cleaning the outside of a window, when the board giving way, as frequently happens, the man was precipitated, and impaled upon the spikes of the iron pales which inclosed the area below, from whence he was conveyed to the hospital with no hopes of recovery. This unhappy man, I was informed, had a large family depending upon him for subsistence. I was so shocked with the circumstance, that I was not easy till I had made a model which I thought would be the means of preventing similar accidents. This model I beg leave to lay before the Society, and if it should be so fortunate as to meet with their encouragement, I will receive any donation from them with thankfulness, and have no doubt that it will be found to possess many advantages. In appearance it resembles a common sash, and the upper or lower sheet may be moved up and down in a similar manner; besides which, by pushing two small springs back in the upper sheet, and at the same time pulling the sash inwards, you may turn the outside of the sash towards you, into the room, so that it may be easily painted, glazed, or cleaned by a person standing within the room, without the necessity of removing the slips or beadings, by doing which, in the common mode, the glass is frequently broken and the beads lost, left loose, or mismatched, and a considerable expense incurred. By turning the lower sash of my invention in an horizontal or inclining direction, you can look into the street without being wet in rainy weather, or the rain driving into the

Mr. G. Marshall's New Window Sash.

Fig. 3.



Mr. Ross's Machine for separating Iron-filings from those of Brass.

Fig. 1.

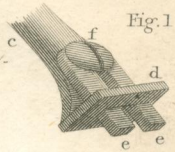
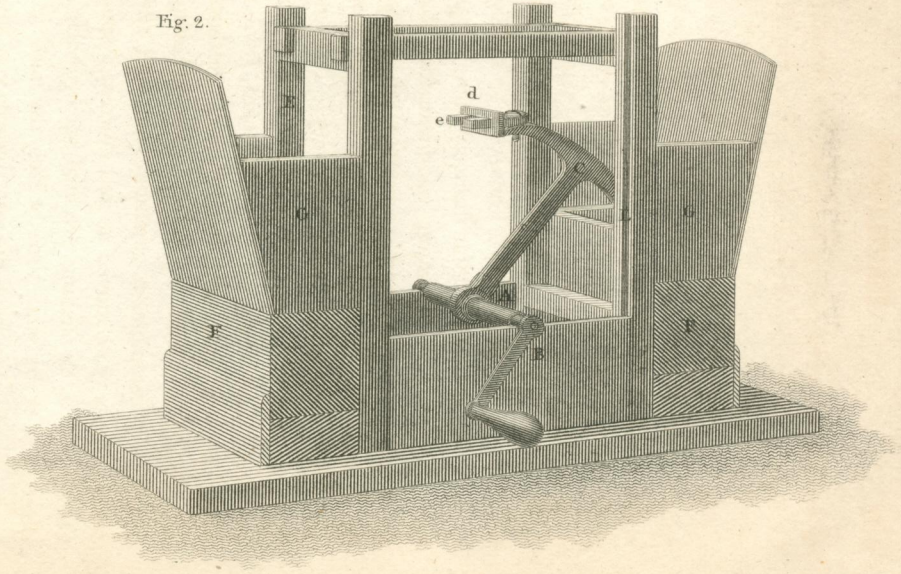


Fig. 2.



Drawn by J. Farey Junr.

Engraved by S. Porter

the room and damaging the furniture. Old windows may be altered to act upon this principle, at an expense of twelve shillings per window; and new sashes and frames may be thus made for only six shillings more than the common price.

I remain, Sir,

Your obedient humble Servant,

GEORGE MARSHALL.

15, *Cecil-court, St. Martin's-lane,*
Feb. 9, 1810.

To C. TAYLOR, M. D. SEC.

Reference to the Drawing of Mr. Marshall's Window-Sash, Fig. 3, *Pl.* 12.

A A represents the window-frame; B B the lower, and C C the upper sash: the frame A A is fitted with grooves, weights, and pulleys, in the usual manner; the fillets on the sash which enter the grooves are not made in the same piece with the sash-frame, but fastened thereto by pivots about the middle of the sash; upon these pivots the sash can be turned as at C C, so as to get at the outside without disturbing the fillets or grooves; when the sash is placed vertical, as B B, two spring-catches at *a a* shoot into and take hold of the sliding fillets, so that in this state the sash slides up or down in the usual manner, but can be immediately released, and turned inside out by pushing back the springs, and at the same time pulling the sash inwards; this turns the outside towards the room, so that the sash may easily be

be painted, glazed, or cleaned on the outside by a person within the room, without removing the beads which confine the sash to slide up and down vertically; in the common way these beads are frequently broken or misplaced, and cause considerable trouble by being always loose. By inclining the sash on its pivots, the highest point being within the room, the window may be left open in the most severe rain without danger of any entering the room, and a person may look out into the street without being wet.

The SILVER MEDAL *of the Society was this Session voted to Mr.* WILLIAM MOULT, *No. 37, Bedford-square, for his Method of applying the Filtering-Stone for purifying Water. The following Communication was received from him. An Explanatory Engraving is annexed, and a Model of the Apparatus is preserved in the Society's Repository.*

SIR,

IF you think the following information, relative to a new method of filtering water, is deserving of the attention of the Society of Arts, &c. I wish you would lay it before them. My objections to the old method of filtering by putting water into the filtering-stone are, that the dirt falls to the bottom, and fills up, or chokes the pores of the filtering-stone, so that the stone requires frequently to be cleaned with a brush and sponge to allow the water to pass, after which

which the water passes through the stone in a muddy state for two or three days; it likewise requires to be frequently filled, and as it empties less water comes in contact with the stone, and therefore a smaller quantity, in such a state, can only pass through. Likewise a filtering-stone used in the common way soon becomes useless, from the filth insinuating itself into the internal parts of the stone, out of the reach of the brush.

In the method I propose and practise, the filtering-stone placed within the water to be purified, which presses upon the outside of the filter, and the stone does not require to be supported in a frame as it needs only to stand within the water cistern; it will thus filter, in an equal time, double the quantity of water procured in the common mode; it fills itself and requires no cleaning. I have upon this plan used one for more than three years with great success.

I am, Sir,

Your humble Servant,

WILLIAM MOULT.

No. 37, *Bedford-square, April* 18, 1810

To C. Taylor, M. D. Sec.

Certificates.

We the undersigned, having inspected and examined a new mode of employing the ordinary filtering-stone, discovered by William Moult, are of opinion that its superiority over the customary method is so great as to entitle it to particular notice.

That it not only supplies an infinitely greater quantity of purified

purified and limpid water, but is capable of preserving its porosity free and pervious for years together, by an occasional self-operation.

That by this valuable process the principal objections to drip-stones is removed, viz. the constant labour they require to keep them clean by means of brushes, without eventually producing the intended effect, and without preventing their being finally rendered useless.

D'Arcy Preston, Captain in the Royal Navy;
Charles Gower, M. D.;
Thomas Pitt, Esq. V. P. Wimpole-street;
Richard Davenport, Esq. Wimpole-street.

Reference to the Drawing of Mr. Moult's Filtering Apparatus, Fig. 1, *Pl.* 13.

A A is the cistern containing the water to be filtered; the filtering-stone B is suspended in the cistern by a ring around the inside of it, which catches the projecting part of the stone; the water in the cistern filters through into the stone. D is a syphon which conveys the filtered water from the inside of the stone into a cistern E, which is the reservoir for clean water. *d* a cock to draw it off as it is wanted. By this mode of filtration the impurities of the water are deposited in the bottom of the cistern A, instead of being left in the bottom of the stone as in the usual mode.

FIFTEEN GUINEAS *were this Session voted to Mr.* BENJAMIN SMITH, *No.* 11, *Turnham-place, Curtain-road, Shoreditch, for his Method of raising a loaded Cart when the Horse in the Shafts has fallen. The following Communication was received from him, and a complete Model, to explain the Principle, is preserved in the Society's Repository.*

SIR,

I HAVE taken the liberty of sending you a model with a brief explanation of the utility of my invention, in order that it may be laid before the Society instituted for the Encouragement of Arts, &c. to whose comprehensive judgment and abilities I with great deference submit it for their determination, whether they think it likely to be attended with the success and utility which I flatter myself it deserves. From the simplicity of the construction and the trivial expense attending it I presume there will be no bar to its universal adoption. I respectfully submit it to the discernment and decision of the Society, who will, I am convinced, give it all the merit and approbation it may deserve.

The reason which prompted me to undertake this business is, from having seen a horse which had fallen down under the immense weight of a heavy-loaded cart, where it lay for a considerable time in that painful and dangerous situation, which naturally excited compassion even in the most obdurate heart. Every person frequenting the streets of this metropolis must have witnessed similar scenes; and indeed it surprises me that long before now some expedients have not been publicly

publicly suggested to remove the mischief arising from such occurrences, considering the great encouragement that is given in this enlightened age to all useful improvements.

Having conversed on this subject with persons who possess considerable knowledge of horses, and who constantly employ these noble animals, I find that horses remaining so long as they usually do in such improper positions, and from being often dragged a considerable distance by fruitless endeavours to raise them, are much endangered in their health and lives, and that their situation upon the stones is more prejudicial than the injury received by the fall.

I flatter myself that my method will be found to raise the whole weight of the cart, and a considerable part of that of the horse, in the short space of three or four minutes from the moment of the accident, by means simple and useful, and within the reach of the meanest capacity to execute; and that the whole apparatus will not cost above fifty shillings, and will last many years. Requesting your kind attention,

I am, Sir,

Your most obedient Servant,

BENJAMIN SMITH.

No. 11, *Turnham-place, Curtain-road, Shoreditch, London, Dec.* 13, 1809.

To C. TAYLOR, M. D. SEC.

Advantages derivable from this Invention:

1.—The invention is of itself so simple, and the operation so conspicuous at the first view, that the whole process may be easily comprehended and executed.

2.—The

2.—The apparatus may be fitted with little difficulty to any cart now in use for heavy loads, such as bricks, coals, corn, or the like.

3.—The chains which lead from the uprights at the back part of the cart to the fore part of it on each side are for the purpose of taking the purchase therefrom, and making the back part of the cart act as a lever at the time the horses are drawing behind, which without fail, with the strength of one, two or three horses fastened there to raise the one which is down in the shafts, will instantly assist him to get upon his feet.

4.—The number of horses to draw a cart are usually in proportion to the weight contained therein; therefore supposing three horses are employed to draw it, and the shaft horse falls, the carman has only to unhook the two leaders and then hook them to the short chain at each side of the back of the cart, and with their strength the fallen horse will be so relieved from the weight as to raise himself without further assistance.

5.—The same principle may be applied in different ways from what I have shown in the model; for instance, another mode may be adopted by framing the tail board of the cart strong enough to bear the purchase, and with the use of the two side chains above-mentioned, it may be made to answer the purpose.

Another plan, though more expensive, is by obtaining two wrought-iron uprights to be fixed as substitutes for the truss-staffs at the back part of the cart, with a hole in the top of each to receive an iron rod, which is occasionally to be introduced, reaching from one side of the cart to the other, connecting the two uprights together; when in action the two side chains to be used as in other cases.

Reference to the Drawing of Mr. Smith's Method of raising up a Horse when fallen down in the Shafts of a loaded Cart, Fig. 2, Pl. 13.

A is the wheel, and B the shafts of a cart, such as is used in London; C the side rails; at the end of the body an iron stancheon or truss-staff, *a*, is fixed by a hinge at the lower end, and at the upper end it is supported by a chain *b*, extended from the fore part of the body of the cart; this diagonal chain forms a firm support to the stancheon. This is all the addition made to the common cart, and is used in the event of the shaft-horse falling, by hooking the traces of the other horses to a chain *d*, also fixed to the stancheon; the power of these horses, applied at this height above the fulcrum, will have a great purchase to elevate the shafts and set the fallen horse at liberty, as is evident from an inspection of the figure. The stancheon moves on a joint on its lower end, and the oblique chain unhooks at *b*; the end can be connected with a short piece of chain *e* fastened to the last of the side-rails; the stancheon now takes the position of the dotted lines *f*, and the short chain which hangs down perpendicular from the end of it, may be taken hold of by any number of men, to weigh upon and raise the cart in cases where the horses cannot conveniently be applied; the men will in this manner have much greater effect than merely (as is the common practice) weighing on the hind part of the cart.

When the chain is completely detached, and the stancheon suffered to hang down perpendicularly, it forms a prop to support the cart steady whilst it is unloaded. It should be observed, that though only one stancheon appears in the figure, there are in fact two, one being placed on each side of the cart.

CERTIFICATE.

Mr. Moult's Filtering Apparatus.

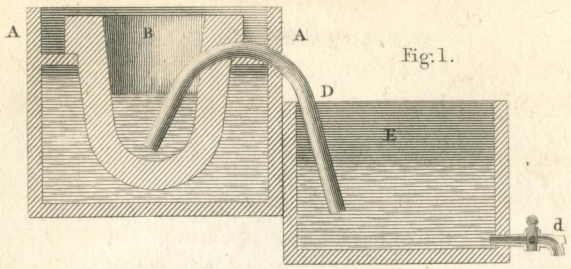


Fig: 1.

Mr. Smith's method of relieving a Horse which has fallen in the shaft of a loaded Cart.

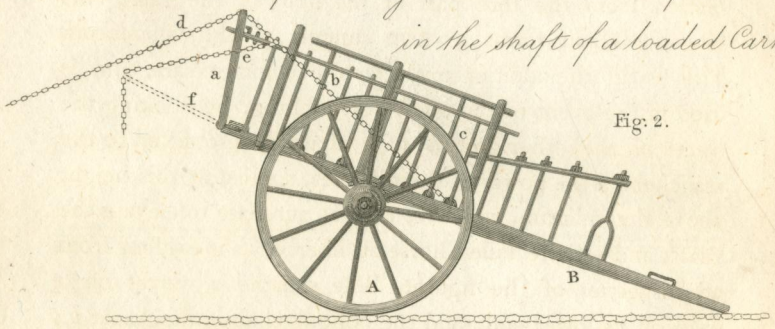


Fig: 2.

Mr. Taylor's Air Exhauster for Mines.

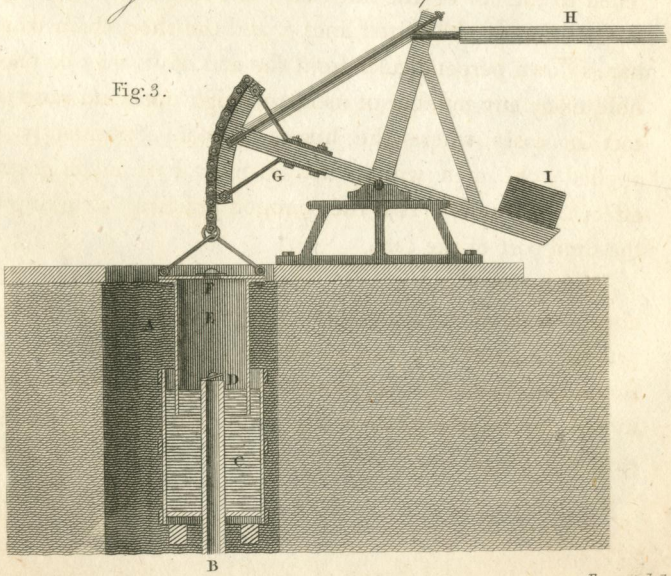


Fig: 3.

Drawn by J. Farey Junr.

Engraved by S. Porter.

CERTIFICATE.—Mr. WILLIAM WHITEHEAD, Jun. of Cadogan-place, Sloane-street, certified, that he had attended experiments made to ascertain the efficacy of Mr. Smith's invention; that a cart weighing twenty-three hundred-weight, loaded with one ton of stones, was raised by means of Mr. Smith's apparatus with ease by one horse.

That he very much approves of Mr. Smith's invention, and thinks it likely to be of great service in general practice, more especially on account of the business being effected with little expense. That many carts are already so formed that very little additional apparatus will be required to complete them for the purpose.

The SILVER MEDAL *of the Society was this Session voted to Mr.* JOHN TAYLOR, *of Holwell, near Tavistock, for his Method of Ventilating Mines, or Hospitals, by extracting the foul Air from them. The following Communication was received from him. An Explanatory Engraving is annexed, and a Drawing of the Apparatus is preserved in the Society's Repository.*

SIR,

I SEND you herewith a drawing and description of a machine of my invention for the ventilation of mines, with a

view to their being laid before the Society for the Encouragement of Arts, &c. and hope they will meet with their approbation.

I am, Sir,

Your obedient Servant,

JOHN TAYLOR.

Holwell, April 9, 1810.

To C. TAYLOR, M. D. SEC.

On the Ventilation of Mines, with the Description of a new Machine for that Purpose. See Pl. 13. *Fig.* 3.

Next in importance to the means employed for draining underground works from water may be reckoned those which are intended to afford a supply of pure air, sufficient to enable the workmen to continue their operations with ease and safety to themselves, and to keep up, undiminished, the artificial light upon which they depend. It is well known, indeed, to all who are practically engaged in concerns of this kind, that men are frequently obliged to persevere in their labour, where a candle will scarcely burn, and where not only their own health materially suffers in the end, but their employers are put to considerable additional expense by the unavoidable hinderance and the waste of candles and other materials.

I mean to confine the following remarks to such mines as are worked upon metalliferous veins, according to the practice of this district, and that of the great seat of mining in the neighbouring county of Cornwall, from which indeed our's

our's is borrowed. We find then that a single shaft, not communicating by levels to another, can hardly be sunk to any considerable depth, nor can a level (or as the foreign miners call it, a gallery) be driven horizontally to any great distance without some contrivance being had recourse to for procuring currents of air to make up the deficiency of oxygen, which is so rapidly consumed by respiration and combustion in situations like these, where otherwise the whole remains in nearly a stagnant condition.

We are here unacquainted with the rapid production of those gasses which occasionally in the collieries are the cause of such dreadful effects; such as hydrogen gas, or the fire-damp, carbonic acid, or the choke-damp; the inconvenience we experience takes place gradually as we recede from the openings to the atmosphere, and seems to arise solely from the causes I have before assigned, though it is found to come on more rapidly in certain situations than in others.

The most obvious remedy, and that which is most frequently resorted to, is the opening a communication either to some other part of the mine or to the surface itself, and as soon as this is done the ventilation is found to be complete, by the currents which immediately take place, often with considerable force, from the different degrees of temperature in the subterranean and upper atmospheres; and these currents may be observed to change their directions as the temperatures alternate.

The great objection to this mode of curing the evil is, the enormous expense with which it is most commonly attended. In driving a long level, or tunnel, for instance, it may happen to be at a great depth under the surface, and the intervening rock of great hardness; in such a case every shaft which must be sunk upon it for air alone, where not required (as often they might not) to draw up the waste, would cost

several hundred pounds; or in sinking a shaft it may be necessary, at an expense not much less, to drive a level to it from some other for this purpose alone.

To avoid this, recourse has been had to dividing the shaft or level into two distinct parts, communicating near the part intended to be ventilated, so that a current may be produced in opposite directions on each side the partition, and this, where room is to be spared for it, is often effectual to a certain extent. It is found however to have its limits at no very great distance, and the current at best is but a feeble one, from the nearly equal states of heat in the air on each side. The only scheme besides these, that I know of, has hitherto been to force down a volume of purer air, through a system of pipes placed for the purpose, and a variety of contrivances have been devised for effecting this; most of them are so old that they may be found described in Agricola's work *De re Metallicâ*. The most common are by bellows worked by hand; by boxes or cylinders of various forms placed on the surface with a large opening against the wind, and a smaller one communicating with the air-pipes by a cylinder and pistern working in it, which when driven by a sufficient force has great power; but the cheapest and most effectual scheme for this purpose, where circumstances will admit of its being applied, is one which I adopted some time since in the tunnel of the Tavistock canal. It is by applying the fall of a stream of water for this purpose, and it has been long known that a blast of considerable strength may be obtained in this manner, which has the advantage of being constant and self-acting. The stream being turned down a perpendicular column of pipes, and dashing in at a vessel so contrived as to let off the water one way, with an opening at another part for the air, which being pressed into it by the falling water, may be conveyed

in

in any direction, and will pass through air-pipes with a strong current, which will be found efficacious in ventilating mines in many instances, as it has likewise, in some cases, been sufficient for urging the intensity of fires for the purposes of the forge. It is easily procured where a sufficient fall is to be had, and the perpendicular column can be so fixed as that the water from the bottom may pass off, while the air is forced into a pipe branching from the air-vessel, and which is to be continued to the part of the mine where the supply of fresh air is required.

I have found, however, that the forcing into vitiated air a mixture of that which is purer, even when the best means are used, though a measure which affords relief, is not in bad cases a complete remedy, and where the operation depends on manual labour, or any means that are not unremitted in their action, it becomes quite ineffectual. The foul air, charged with the smoke of gunpowder used in blasting, and which it strongly retains, is certainly ameliorated by the mixture of pure air, but is not removed. While the blast continues, some of it is driven into the other parts of the mine; but when the influx of pure air ceases it returns again, or if during the influx of pure air a fresh volume of smoke be produced by explosions which are constantly taking place, it is not until some time afterwards that it becomes sufficiently attenuated for the workmen to resume their stations with comfort.

A consideration of these circumstances led me to think that the usual operation of all ventilating engines ought to be reversed to afford all the advantages that could be desired; that instead of using the machines, which serve as condensers, exhausters should be adopted; and thus, instead of forcing pure air into that in a vitiated state, a complete

remedy could only be had by pumping out all that was impure as fast as it became so.

Many modes of doing this suggested themselves to me, by the alteration of the machines commonly applied, and by producing an ascending stream of air through pipes by a furnace constructed for the purpose. The latter mode would however have been here expensive in fuel as well as in attendance, and the others required power to overcome the friction of pistons, and so on, or considerable accuracy in construction.

I at last erected the machine, of which the annexed is a drawing, which, while it is so simple in construction, and requires so small an expense of power, is so complete in its operation, and its parts are so little liable to be injured by wear, that as far as I can imagine, nothing more can be desired where such a one is applied. This engine bears considerable resemblance to Mr. Pepy's gazometer, though this did not occur to me until after it was put to work, it will readily be understood by an inspection of the drawing, where the shaft of the mine is represented at A; and it may here be observed, that the machine may be as well placed at the bottom of the shaft as at the top, and that in either case it is proper to fix it upon a floor, which may prevent the return of the foul air into the mine, after being discharged from the exhauster; this floor may be furnished with a trap-door to be opened occasionally for the passage of buckets through it.

B the air pipe from the mine passing through the bottom of the fixed vessel or cylinder C, which is formed of timber and bound with iron hoops; this is filled with water nearly to the top of the pipe B, on which is fixed a valve opening upwards at D.

E the

E, the air, or exhausting-cylinder, made of cast-iron, open at the bottom and suspended over their air-pipe, immersed some way in the water. It is furnished with a wooden top, in which is an opening fitted with a valve likewise opening upwards at F.

The exhausting-cylinder has its motion up and down given to it by the bob G, connected to any engine by the horizontal rod H, and the weight of the cylinder is balanced, if necessary, by the counterpoise I.

The action is obvious.—When the exhausting cylinder is raised, a vacuum would be produced, or rather the water would likewise be rained in it, were it not for the stream of air from the mine rushing through the pipe and valve D. As soon as the cylinder begins to descend, this valve closes and prevents the return of the air which is discharged through the valve F.

The quantity of air exhausted is calculated of course from the area of the bore of the cylinder, and the length of the stroke.

The dimensions which I have found sufficient for large works are as follow:

The bore of the exhausting cylinder two feet.

The length six feet, so as to afford a stroke of four feet.

The pipes which conduct the air to such an engine ought not to be less than six-inch bore.

The best rate of working is from two to three strokes a minute; but if required to go much faster it will be proper to adapt a capacious air-vessel to the pipes near the machine, which will equalize the current pressing through them.

Such an engine discharges more than two hundred gallons of air in a minute; and I have found that a stream of water supplied by an inch and a half bore falling twelve feet, is sufficient to keep it regularly working.

A small

A small engine to pump out two gallons at a stroke, which would be sufficient in many cases, could be worked by a power equal to raising a very few pounds weight, as the whole machine may be put into complete equilibrium before it begins to work, and there is hardly any other friction to overcome but that of the air passing through the pipes.

The end of the tunnel of the Tavistock Canal, which it was my object to ventilate, was driven into the hill to a distance of near three hundred yards from any opening to the surface, and being at a depth of one hundred and twenty yards, and all in hard schistus rock, air-shafts would have been attended with an enormous expense; so that the tunnel being a long one, it was most desirable to sink as few as possible, and of course at considerable distances from each other. Thus a ventilating machine was required, which should act with sufficient force through a length of near half a mile, and on the side of the hill where it first became necessary to apply it, no larger stream of water to give it motion could be relied on, than such a one as I have mentioned after the description of the engine, and even that flowed at a distance from the shaft where the engine was to be fixed, which made a considerable length of connexion-rods necessary.

Within a very short time after the engine began to work, the superiority of its action over those formerly employed was abundantly evident. The whole extent of the tunnel which had been uninterruptedly clouded with smoke for some months before, and which the air that was forced in never could drive out, now became speedily so clear, that the day light and even objects at its mouth were distinctly seen from its farthest end. After blowing up the rock, the miners could instantly return to the place where they were employed, unimpeded by the smoke, of which no appearance would remain underground in a very few minutes, while it might

might be seen to be discharged in gusts, from the valve at the top of the shaft. The constant current into the pipe, at the same time effectually prevented the accumulation of air unfit for respiration. The influx of air, from the level into the mouth of the pipe, rushes with such force as instantly to extinguish the flame of a large candle; and any substance applied, so as to stop the orifice, is held tight by the outward pressure.

It is now more than two years since the machine was erected, and it has been uninterruptedly at work ever since, and without repair. The length of the tunnel has been nearly doubled, and the pipes of course in the same proportion, and no want of ventilation is yet perceptible.

Two similar engines have been since constructed for other parts of the same tunnel, and have in every respect answered the purpose for which they were designed.

The original one is worked by the small stream of water before-mentioned, by means of a light overshot-wheel twelve feet in diameter, and about six inches in breast.—The two others are attached to the great overshot-wheel which pumps the water from the shafts which are sinking upon the line, and as their friction is comparatively nothing, this may be done in any case, with so little waste of power for this purpose as not to be an object of consideration, even if the power be derived from more expensive means.

The size of the exhauster may always be proportioned to the demand for air, and by a due consideration of this circumstance, this engine may be effectually adapted not only to mines and collieries, but also to manufactories, workhouses, hospitals, prisons, ships, and so on.

Thus, if it were required to ventilate a shaft of a mine, or a single level, which is most frequently the case, where three men are at work at one time, and we allow that those three

three men vitiate each twenty-seven and a half cubic inches of air per minute, (as determined by the experiments of Messrs. Allen and Pepys), and allowing further that their candles vitiate as much as the men, there will be six times twenty-seven and a half cubic inches of air to be drawn out in a minute, equal to one hundred and sixty-five.

Now a cylinder five inches in diameter, working with a stroke of nine inches, will effect this by one stroke in a minute, though it would certainly be advisable to make it larger.

Not being practically acquainted with collieries, or mines that suffer from peculiar gasses that are produced in them, I cannot state, from actual experiment, what effect this machine might have in relieving them; but it must appear, I conceive, evident to every person at all acquainted with the first principles of pneumatics, that it must do all that can be wished, as it is obvious that such a machine must in a given time pump out the whole volume of air contained in a given space, and thus change an impure atmosphere for a better one. And in constructing the machine it is only necessary to estimate the volume of gas produced in a certain time, or the capacity of the whole space to be ventilated. It is easy to judge how much more this must do for such cases as these, than such schemes as have lately been proposed of exciting jets of water, or slaking lime, both of which projects, likewise, must fail when applied; as one of them has, I believe, been proposed to be to the case of hydrogen gas. But with such a machine as this, if the dreadful effects of explosions of this air are to be counteracted, it may be done by one of sufficient size to draw off this air as fast as it is generated; and by carrying the pipes into the elevated parts of the mine where from its lightness it would collect. If, on the other hand, it is desired to free any subterraneous work from the carbonic acid-gas, it may as certainly

certainly be done by suffering the pipe to terminate in the lower parts, where this air would be directed by its gravity.

In workhouses, hospitals, manufactories, &c. it is always easy to calculate the quantity of air contained in any room, or number of rooms, and easy to estimate how often it is desirable to change this in a certain number of hours, and to adjust the size and velocity of the engine accordingly. Where this change of foul air for pure is to take place in the night, means for working the machine may be provided by pumping up a quantity of water into a reservoir of sufficient height to admit of its flowing out during the night in a small stream, with sufficient fall, so as to give motion to the engine; or by winding up a weight of sufficient size, or by many other means which are easily devised.

If, for instance, a room in which fifty persons slept was eighty feet long, twenty wide, and ten high, it would contain 16,000 cubic feet of air, and if this was to be removed twice in eight hours, it would require a cylinder of thirty inches diameter, working with a four-foot stroke four times in a minute, to do it; or nearly that. Such a cylinder could be worked by the descent of ten gallons of water ten feet in a minute; or, for the whole time, by eighty hogsheads falling the same height.

But this is a vast deal more than could be required, as the fifty people would, in eight hours only, vitiate three thousand gallons of air, which could be removed by one hundred and fifty strokes of a cylinder, twelve inches diameter, with a four-feet stroke, which would not require an expenditure of more than one thousand five hundred gallons of water properly applied, or about twenty-eight hogsheads.

JOHN TAYLOR.

Holwell, near Tavistock, Feb. 7, 1810.

CERTIFICATE.

CERTIFICATE.

An extract from the Report of the Committee of Management of the Tavistock Canal, to the General Meeting of Proprietors, held in August 1808, stating that great impediments had arisen from the want of good air in the tunnel when distant from a shaft, then adds—" For the purpose of rendering the ventilation in the tunnel completely good, and of doing it in a manner that may be applied to very considerable lengths in driving, the engineer has erected machines, acting upon the simplest principle, and without friction, which exhaust from the very place in which the men are working a continued volume of vitiated air; the place of which, of course, is as constantly supplied with fresh air, by the pressure of the atmosphere, and thus all difficulty on this head completely ceases."

FIFTEEN GUINEAS *were this Session voted to Mr.* ADAM REID, *of Green's End, Woolwich, for a Compensation Pendulum for a Clock. The following Communication was received from him. An explanatory Engraving is annexed, and a Model and Drawing of the Pendulum is preserved in the Society's Repository.*

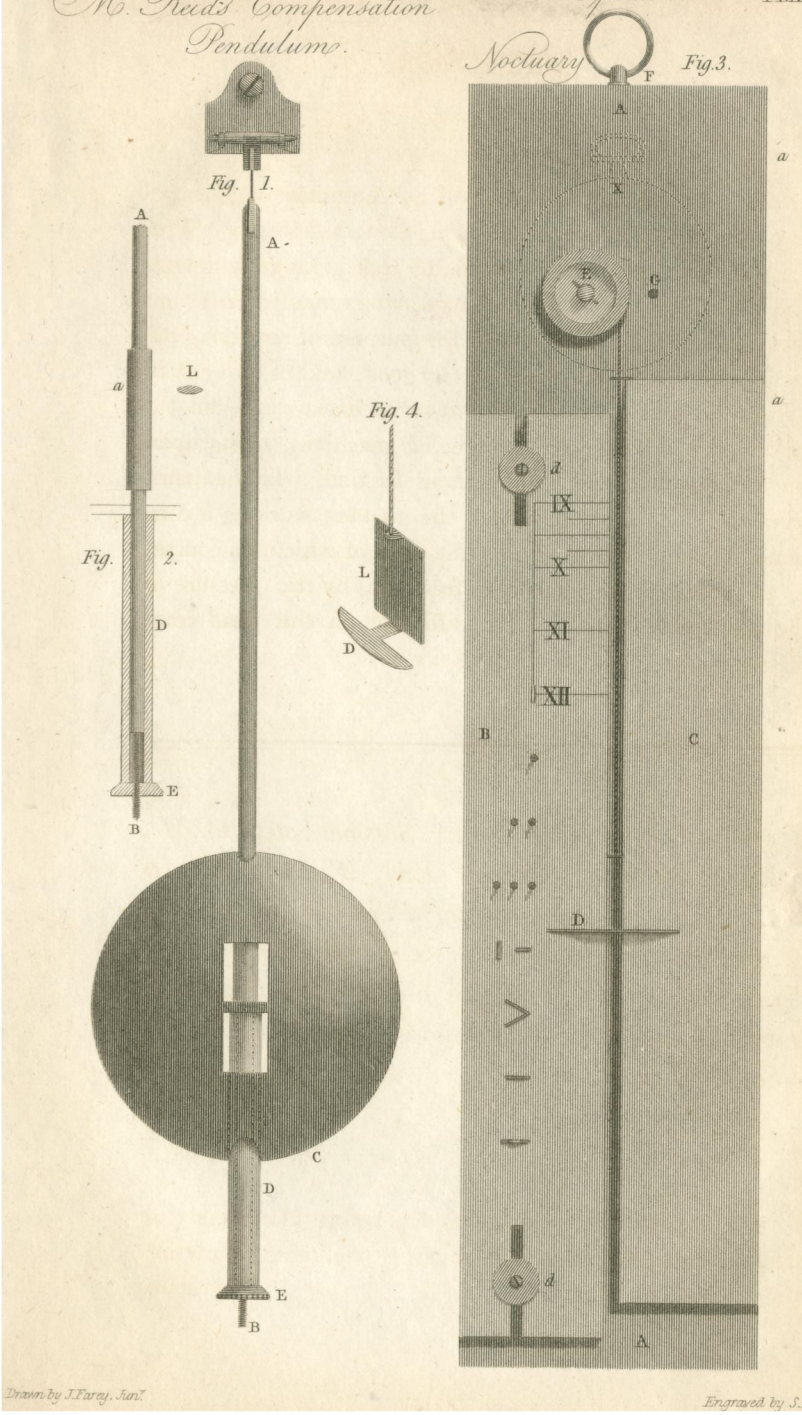
SIR,

YOU will have the goodness to lay before the Society of Arts, &c. a half-second compensating pendulum of my invention;

Mr. Reid's Compensation Pendulum.

Mr. Sparks. Pl. XIV.

Noctuary Fig. 3.



Drawn by J. Farey, Junr.

Engraved by S. Porter.

vention; which is so simple in its construction that it will be fully understood by viewing either the pendulum, or the drawing which accompanies it. I believe it to be new, and wishing it to be useful to the world, I have presumed to send it to the Society.

I am, Sir,

Your humble Servant,

ADAM REID.

To C. TAYLOR, M. D. SEC.

Reference to the Drawing of Mr. Reid's Compensation Pendulum, Pl. 14.

Fig. 1 and 2, pl. 14, A B represent the steel rod extending through the whole. C the bob, supported upon the compensating cylinder of zinc D, which surrounds the rod A B, and rests upon the nut E of a screw tapped upon the end of the steel rod, to bring it to exact time; as this expands downwards by heat, the zinc expands upwards the same quantity; so that the bob always remains at the same distance from the point of suspension. Fig. 2, is a section to explain more clearly the thickness of the zinc tube D, and the form of the steel rod at *a*, where it passes through the bob, which is of the shape shewn at L, that the rod or the bob may not turn round when the nut E is turned to adjust it to time.

The

The following Method is to be employed to make the Compensating Pendulum of Steel and Zinc.

Procure a rod of forged Blister-steel 52·7 inches long, ·27 diameter, heat it to a white heat which will open the pores of steel, and give it the smallest expansive power that steel of that texture is possessed of; when cold straighten it with a mallet of wood on a wooden block, that no part may be condensed partially, which would be the case if a hammer and anvil were used. Then cast a solid rod of zinc 12·5 inches long, ·68 diameter, with the lowest heat that will fuse it; pour it into a metal mould; this will give it the greatest density, consequently the greatest expansion that zinc is possessed of. Then bore a hole through the centre of it longitudinally, that it may move freely on the steel rod, which has a nut and screw at the bottom end to regulate the clock to time; the bob, as shewn in the engraving, rests on the upper end of the cylinder of zinc, and will continue in the same place, whatever expansion or contraction takes place, if the adjustment be correct.

If platina was used instead of steel, and steel instead of zinc, a pendulum might be made equally good, and more compact; but not at so small an expense.

The above dimensions are to be understood in the finished state of their diameters and lengths, proper for a second pendulum.

I have constructed a pendulum on this principle, which has been in use some months, and I have the satisfaction to find it has answered my expectations; the temperature of the room was from 58 to 84 degrees, and no variation of the clock, when compared with my other clock, which from many

many years trial, I know to be a good one, in a room where the thermometer does not vary more than four degrees.

The difficulty, or rather impossibility of making a good pendulum, where a compound metal as brass is employed, arises from the circumstance that neither brass nor any compound metal can be made uniform, not even for one foot in length; and then if drawn into wire the parts acquire a longitudinal grain, which adds to the variation of the expansive powers. To avoid this, zinc has been substituted, with no more certainty of success; for if a pendulum is made in the summer, and the steel pins fill the holes well, and it is exposed to a severe frost, and put to the clock for only a few years, the invisible fissures will become visible in the performance of the best clock, and a visible separation render the pendulum useless; as I have witnessed.

I am willing to furnish the Society with any further information in my power upon the subject.

ADAM REID.

Woolwich, April 27, 1809.

The SILVER MEDAL *was this Session voted to Mr.* G. SPARK, *of Elgin, Murrayshire, Scotland, for his Method of ascertaining the Hour in the night, by an Apparatus, connected with a common Watch. The following Communication was received from him. An Explanatory Engraving is annexed, and a complete Apparatus preserved in the Society's Repository.*

SIR,

BY Mr. John Newton, watchmaker, I have forwarded an invention for knowing the hour in the dark, by feeling. I think it preferable to a repeater, on account of its simplicity and cheapness. It is not liable to be out of order, and it does not require the exertion necessary for pushing the pendant of a repeater, nor disturb any person near it.

For these reasons I diffidently wish to have the honor of laying this invention, which I call a Noctuary, before the Society; and to be favored with their decision on its merits.

I am, Sir,
Your respectful and obedient Servant,
GEORGE SPARK.

Elgin, March 7, 1810.

To C. TAYLOR, M. D. SEC.

Reference to the Engraving of Mr. Spark's Noctuary, Pl. 14, *Fig.* 3.

A A, fig. 3, is a mahogany board, upon which two others, B and C, are fixed, so as to form a groove between and underneath

derneath them, in which the index D, shown separately at fig. 4, descends;—on the opposite side of the board a flap or door of mahogany is fixed, by two hinges *a a*, and a clasp; between this and the board A A, a cavity is formed to contain the watch, as shewn by the dotted circle X; the dial appearing through a circle in the door, a hole is made through the board A, opposite the fusee-square, to receive a key, upon which the small pully E is fixed, and from which the index D is suspended by a fine thread in the groove above-mentioned. It is plain that as the fusee-square and pulley E revolve, the index descends, and points out the hour by coming opposite the several marks, commencing at nine and ending at seven, which are fixed upon the board B; the marks, from twelve to seven, are made by pins projecting from the surface, so as to be readily distinguished by the finger; the index, represented in perspective at L, fig. 4, is made very light that it may not influence the motion of the watch. The watch must be wound up before it is placed in the frame, and the thread wound up on the pulley E, so much as to suspend the index nearly the height of the hour when it is set; the key is then pushed on the fusee-square, and if the index does not point exactly at the right hour, the scale B can be slided up or down to adjust it; the screws *d d*, which hold it, being fitted in grooves for that purpose; after this setting, the index will point out any succeeding hour descending a division at each. F, is the ring by which the instrument is suspended; and G is a hole in which the key on the pulley E is placed when the watch is removed, and the instrument out of use.

The SILVER MEDAL *of the Society was this Session voted to Mr.* J. WHITFORD, *Surgeons' Instrument Maker, St. Bartholomew's Hospital, for his Elastic Truss for Ruptures. The following Communication was received from him. An Explanatory Engraving is annexed, and a Truss preserved in the Society's Repository.*

SIR,

I HAVE taken the liberty of introducing to the notice of the Society an elastic steel truss, on an entire new principle, as to the curvature of the spring and form of the pad. Many alterations and improvements have been made in the construction of trusses; but none of them have been properly adapted to the curvature of the body before mine, which is made of a serpentine form, and passes on the ruptured side just below the outer edge of the christa of the ilium, as far as the posterior superior spinous process of that bone; it then goes straight across to the same point of the opposite bone, and pursues its course on the sound side of the pelvis in the same relation to the crista ilii, as it held on the side of the rupture as far as the anterior superior spinous process; where it terminates as usual in a leathern strap. In this mode of construction the motions of the trunk and thigh cannot derange the instrument, which acquires a still further stability from the extension of the spring round the sound side of the pelvis. The above anatomical description of the truss is taken from Mr. Lawrence's Treatise on Hernia, page 41. In addition to the improved spring,

spring, I have added a small projection on the pad, which has been found to answer most completely, as it causes a double pressure, the one on the aperture where the hernia descends, whilst the other part of the remaining pad adapts itself to the outer surface of the groin in the usual way.

I have likewise sent two springs, a double one and a single one uncovered, to show in what manner they are made. They are all in one piece except just at the neck of the pad.

I should have sent the trusses sooner for inspection, but I wished previously to try their effects to the fullest extent; which, I am happy to say, have answered my expectations in every respect. I hope, after it has been examined, I shall meet with the encouragement due to its merits.

I am, Sir,

Your most obedient humble Servant,

J. WHITFORD.

St. Bartholomew's Hospital,
Nov. 22, 1809.

To C. TAYLOR, M. D. SEC.

CERTIFICATES.

Mr. WILLIAM LAWRENCE, Demonstrater of Anatomy at St. Bartholomew's Hospital, in his Treatise on Hernia, 8vo. has given a very minute account of Mr. Whitford's truss, and its mode of application is fully explained therein by engravings; he states that he knows it has answered the expectation of the inventor, in some cases where the common trusses had been found inconvenient and insufficient.

Colonel THOMAS THORNTON certified, that being in the habit of taking the most severe exercise, he had been in

the course of wearing trusses as a means of prevention from accident; and that he never met with any truss that answered his purpose so perfectly as that made by Mr. Whitford.

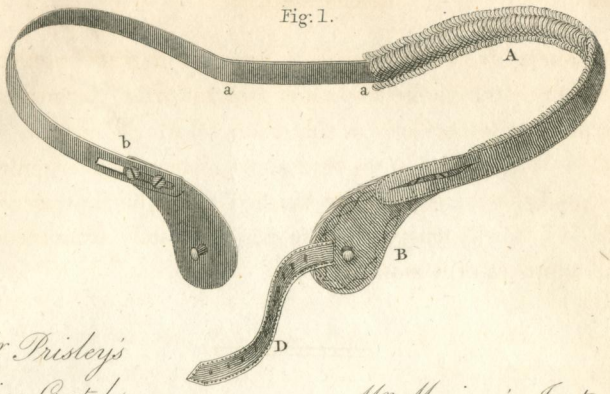
Mr. WILLIAM CHAMBERLAINE, Surgeon, Clerkenwell, declared that he is perfectly satisfied with the superiority of Mr. Whitford's truss; that he has accurately examined it, and approves of it *most highly*.

Reference to the Engraving of Mr. Whitford's Truss, Pl. 15, *Fig.* 1.

A double truss upon Mr. Whitford's plan is represented in perspective at the top of plate 15. One-half A is shewn covered, and furnished with its pad B; and the other half is the steel spring exposed, to explain the straight part at the back *a a*, for the purpose described in Mr. Lawrence's Treatise on Hernia; at *b*, the screws by which the pad can be separated from the spring are shewn; and being fitted in a groove, admit of a small adjustment of the pad to the proper position for any particular case; D is the strap, with a number of holes, to be hooked upon the pin projecting from the opposite pad.

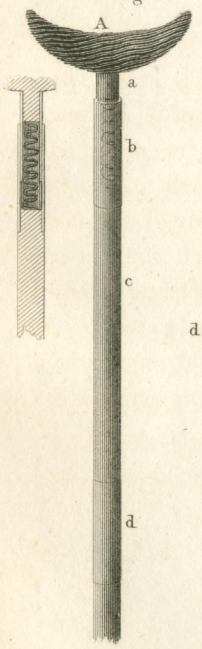
Mr. Whitford's Truss.

Fig: 1.



Mr. Prisley's Spring Crutch.

Fig: 2.



Mr. Morison's Instruments.

Fig: 3.

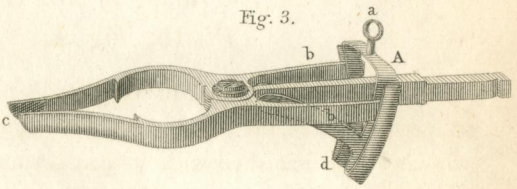


Fig: 4.

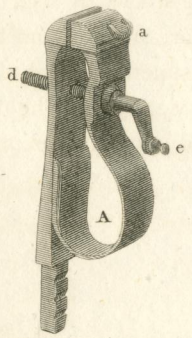


Fig: 5.

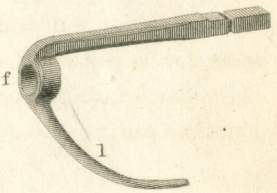
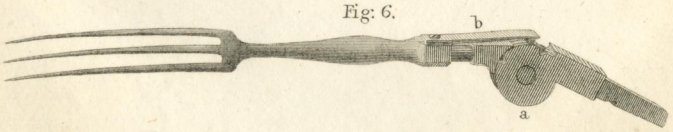


Fig: 6.



Drawn by J. Farey, Junr.

Engraved by S. Porter.

The SILVER MEDAL *of the Society was this Session voted to Mr.* GEORGE PRISLEY, *No. 3, Church-street, Soho, for his Method of constructing Crutches with Springs, to assist Persons who are lame to walk with greater ease. The following Communication was received from him. An Explanatory Engraving is annexed, and Crutches on this construction are preserved in the Society's Repository.*

SIR,

I BEG leave to deliver, for the inspection of the Society, my entire new invention of spring-crutches; which are strongly recommended by the faculty for the use of sick and lame persons.

By means of a spring within them they are more easy in use than common crutches; they are not liable to give such violent shocks to the person who employs them, and can be placed in a small bulk for carriage.

They are the first article of the kind ever offered to the public; and as they have met with the approbation of the faculty in general, I hope they will not be undeserving of the encouragement of the Society.

I remain, Sir,

Your devoted humble Servant,

GEORGE PRISLEY.

No. 3, Church-street, Soho,
London, Nov. 1, 1809.

To C. TAYLOR, M. D. SEC.

CERTIFICATES were received from the Earl of SHAFTESBURY; Mr. H. LEIGH THOMAS, Mr. I. C. CARPUE, Mr. S. HUNT, and Mr. FRANCIS KIERMAN, Surgeons; stating, that they had seen Mr. Prisley's spring-crutches, and strongly recommend them to public notice.

Reference to the Engraving of Mr. G. Prisley's Spring-crutches, Pl. 15, *Fig.* 2.

The head A of this crutch, (see fig. 2, pl. 15,) is fixed upon a short brass tube *a*, which is fitted to slide in another, *b*, fastened upon the top of the staff C; within the tube *a*, a spiral, or helical spring is concealed, which supports the head to be pressed upon, and which yielding in some degree to the pressure, the shocks which are experienced from the use of the ordinary crutches are avoided; at the same time a person can move quicker, and with less fatigue than in the common way; the staff C is made in two halves, which put together in a brass tube *d*, so that they can be divided for the convenience of packing; when the two halves are put together, a spring within the lower part of the staff pressing against the inside of the brass tube *d*, which is fixed to the upper half, prevents the danger of their separating by accident.

The

The SILVER MEDAL *and* FORTY GUINEAS *were this Session voted to Mr.* JOHN MORISON, *No.* 391, *Strand, opposite Cecil-street, for inventing a variety of Implements, by which Persons who have had the Misfortune to lose their Hands may usefully assist themselves. The following Communication was received from him. Explanatory Engravings are annexed, and the Implements described are preserved in the Society's Repository, along with Drawings thereof executed by him.*

SIR,

I SHALL esteem it a singular favor if you will have the goodness to present to the Society of Arts, &c. sundry instruments of my invention for the benefit of persons who have lost their hands. I had the misfortune to lose both mine on board the Atlas armed transport, of London, whilst in the act of loading a great gun to fire a royal salute in honor of his Majesty's birth-day, on the 4th of June, 1805, the said ship being then at anchor in the Cove of Cork. Since the above accident I have taken much pains to invent a variety of implements for the use of persons laboring under similar accidents; and it is my intention to manufacture such instruments as may be wanted by individuals requiring them for any particular circumstance that may occur.

Any

Any reward with which the Society may honor me will be gratefully accepted by,

Sir,

Your obedient humble Servant,

JOHN MORISON.

Sept. 7, 1809.

To C. Taylor, M. D. Sec.

A Committee was appointed on the 16th of November, 1809, by the Society, to consider the various implements invented by Mr. Morison, who, personally attending, stated, that he is a native of Aberdeen, and had lost both his hands and the lower parts of both arms a little below the elbow-joints, in the manner above mentioned.

He produced to the Committee drawings of a great variety of instruments of his invention; and he informed the Committee, that the said drawings and the written explanations which accompanied them were wholly executed by himself.

He explained to the Committee the nature and uses of the several instruments which he brought with him; he unbuttoned and took off his coat and waistcoat in presence of the Committee, and put them on again and buttoned them without any assistance, and said he could entirely dress and undress himself, except the tying on of his neckcloth.

He showed one method of writing by his fixing a pen below his elbow, and a superior method by writing with a pen which he placed above his elbow; in both cases the writing

writing was very fair and clear, and executed with considerable facility.

He took up a glass and drank out of it, and used a knife and fork for carving and eating without any person assisting him.

He showed his method of receiving or paying money as occasion might require, and how to put the money into or take it out of a purse he had contrived for the purpose, and how to take up a small piece of money from the floor.

He can mend a pen by means of the instruments he has contrived, and can wash his face with a sponge placed and managed by himself.

He can use a punch and hammer for making holes in metal, and can work with a file.

He opened and shut the door of the Committee-room, and introduced to the Committee a person named CHARLES TOOL, who had also lost both his hands, and one arm above the elbow-joint; this man also proved to the Committee the comforts and advantages which he had derived from the use of Mr. Morison's instruments, and which answered better than those for which he had paid to other persons double and treble the price.

Mr. Morison stated, that the price of a good set of his instruments would be 10*l.* and that he manufactured them for sale; also trusses, bandages, and artificial legs and arms.

Reference to the Engravings of Mr. Morison's Apparatus, Pl. 15, *Figs.* 3, 4, 5, *and* 6, *and Pl.* 16, *Figs.* 1, 2, 3, *and* 4.

Mr. Morison having the misfortune to lose both his hands, was, from necessity, induced to contrive such instruments as might

might supply the deficiency as far as possible: in this pursuit he has met with great success, being now able to perform the necessary functions of life without difficulty to himself, or requiring assistance from others. It will perhaps appear surprising that a person thus situated should be able to write with great facility, and in a hand not larger than is often used for the common occurrences of business, and written with such apparent freedom, as could scarcely be thought possible. Mr. Morison has also made several very neat drawings (which are now in the Society's possession,) to explain the construction of a great variety of instruments which he has made at various times, and from among which those represented in the engravings were selected as being some of the most ingenious and useful in their application.

A A, fig. 1 of pl. 16, is a tube or socket, formed of strong leather, to receive the stump of the arm; it is open at one side next the open end, and has several holes to lace it on tight; but to prevent any danger of its coming off it is connected with a band B encompassing the arm above the elbow by two rings, one of which is marked *a*; the band is fastened by two double straps with a clasp: at the other end of the tube A a piece of wood is fitted in and faced with a circular iron plate; in the centre of this is a socket to receive the various instruments, one of which, D D, is represented in fig. 1; it terminates in an iron-hook D, useful for lifting any article, as a chair, &c. or drawing on boots; the other part of the instrument is made hollow to receive a button-hook E, and pen or pencil-holder F, either of which can be turned out for use, and are retained in positions of either shut or open by springs similar to that of a knife; behind these a knife G is placed, and can be opened out in a line with the instrument for use, or shut up within the instrument: *b* is a hook

to

Mr. Morison's instruments for Persons who have lost their Hands.

Fig.1.

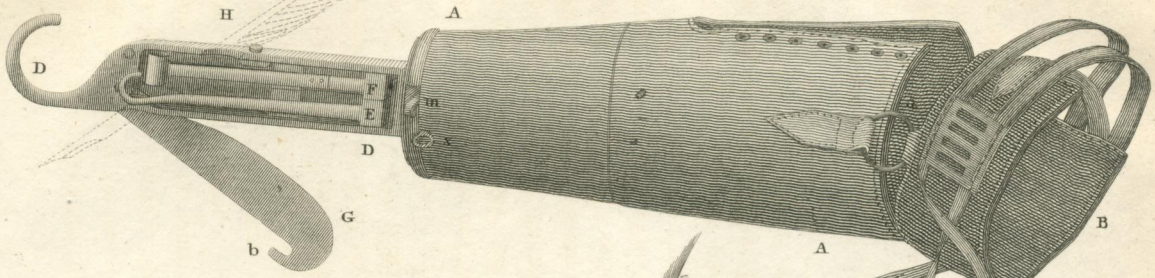


Fig.2.

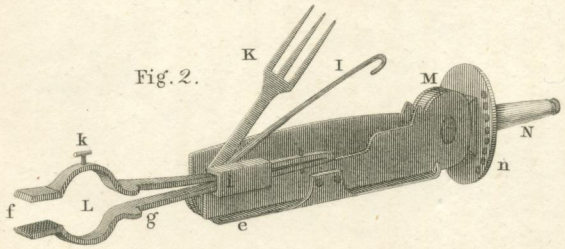
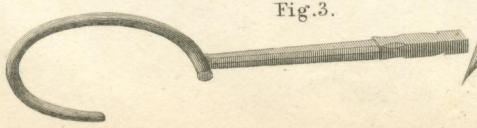


Fig.3.



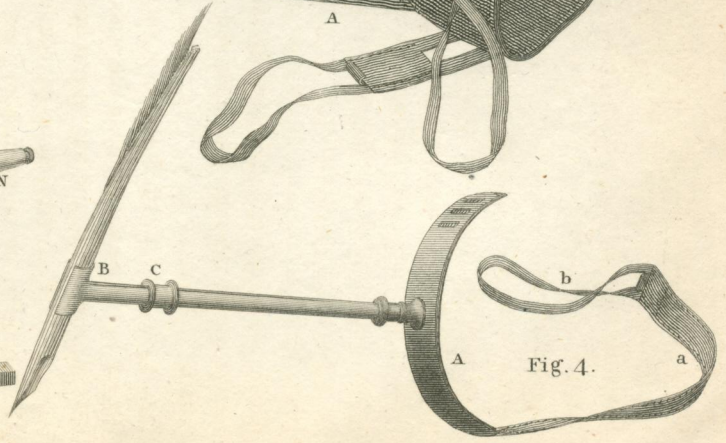


Fig.4.

Drawn by J.Farey Jun.r

Engraved by S.Porter.

to open the knife by. The dotted lines H shew the manner in which a pen, or any similar instrument can be held, the springs of the button-hook and pen-holder being sufficiently strong to hold such articles. The instrument, fig. 1, is adapted to the right arm; the left is provided with a similar leather socket, into which the instrument, fig. 2, is fitted; it contains the button-hook I, fork K, either of which can be opened out for use; *e* is the spring by which they are held; L is a pair of spring-tongs, which slide through a socket *i*, and are by that closed up; they leave two pair of jaws, one at the end *f*, the other by the side at *g*; *k* is a small hook, by which the tongs can be opened by the button-hook of the other hand; the whole of the instrument, fig. 2, bends at a joint M, just where it joins the stump, and the end of the spring *e* catches in notches in the joint to hold it sufficiently firm at any particular point where it is set, by pressing the instrument on the knee, a table, or other fixture. N is the pin which enters the stump; it has a notch all round it at the end, into which a wedge in the stump is received to hold it in; this wedge comes to the outside of the leather at *x*, fig. 1, and has a hook by which it can be pulled by the button-hook of the other hand so as to release the instrument; this wedge does not, however, prevent the whole instrument turning round in the stump, but by means of holes in the circular plate *n*, and a spring-catch at *m*, fig. 1, which enters any of them, the instrument can be fixed in any position; the catch *m* is relieved by pressing it upon the table, &c. the instrument can then be turned round, but becomes fixed when the catch is at liberty. Besides the socket in the centre of the stump, a smaller one is situated in the end thereof, provided with its catch; it is used to hold several small instruments, some of which are represented; fig. 3 is a hook to take up a glass, or for hooking

hooking up light articles. Fig. 3, pl. 15, is a pair of tongs which are opened and shut by a double-inclined plane A, which moves on a centre by means of the button-hook introduced through the ring *a*; when this is moved it opens or shuts the tails *b* of the tongs, and produces a corresponding motion of the jaws *c* to grasp any small articles; these are very convenient, for by pressing the lower part *d* of the inclined-plane on the table, the tongs are closed without the assistance of the other hand, and by striking the ring *a* under the table they are opened again.

Fig. 4, of the same plate, is a small vice, its spring A acting to close it; it is opened by the hook *a*, and any article being put between the teeth is held lightly by the spring, then by turning the screw *d* by its handle the work is pinched fast: to turn this handle the hook, fig. 5, is put into the socket of the opposite stump, and the pin *e* of the vice being entered into the hole *f*, a rotatory motion can be given to the screw; the hook *l* is used to open the vice, and to move the work which is to be held therein. In this vice Mr. Morison holds a file, or other tool to operate upon any piece of work held in the bench-vice, the handle of which he moves by his knee; he has also a socket in which he can place a hammer or any other tool; this socket is inserted into the small socket of the stump.

Fig. 6 is a fork which is preferable to that in the instrument (fig. 2, pl. 13,) in its appearance, as it can be fitted into the small socket of the stump at the same time that an artificial hand is fixed in the centre socket, the fork having a joint *a*, with a spring *b* to hold it, can be bent as necessary, and the fingers of the artificial hand being brought to touch the shank of the fork, will have a natural appearance; one of the artificial hands is provided with a money-box in the wrist with a sliding cover.

Fig.

Fig. 4, of pl. 16, is a pen-holder fixed to a clasp A, which embraces the arm above the elbow, and is held on by a strap and hook-clasp *a*, to this a tape *b* is sewed to take hold with the button-hook and clasp it; by this means Mr. Morison can fasten this apparatus (as also fig. 1,) upon his arm without assistance, he prefers this pen-holder to that in fig. 1, and uses it in all cases except for signatures, &c. which would not be worth the trouble of fitting on the instrument fig. 4; the pen, in fig. 4, comes directly before the person using it, and is turned round when necessary in its holder B by the teeth, the sliding-ring C being drawn up tight to fasten it by the hook of the other hand; the manipulation of putting on this pen-holder is not easily described; the stem of B is held between the knees, whilst the clasp A is hooked as above-mentioned, by drawing the tape *b* tight over the arm; the ring *c* being slid back the pen is held in the mouth to place it in the holder B where it is fixed by the other hand: Mr. Morison uses a high table to write at, and the left hand is employed to hold the paper.

To pick up a pin or other small article the tongs of fig. 2 are used; if it is lying upon a table the jaws *f* of these tongs are placed on each side of the pin, and by pressing on the stump the socket *i* slides towards them, and closes the tongs around the pin: In some cases the side-jaws *g* are more convenient, the tongs must then be moved by the button-hook of the other hand applied to the hook *k*.

These are the principal instruments which Mr. Morison has invented, being chiefly such as he uses himself; but he has made a great number of others for different people in the same unfortunate state: for this purpose he has established a manufactory for these and similar articles, and adapts the instruments to the particular case and employment of his patients.

patients. Many of these instruments are in possession of the Society, where his address at all times may be had.

The Society's Rewards were presented to Mr. Morison by the hands of his Grace the Duke of Norfolk, the President, on the 20th of May, 1810, at which time SAMUEL HOMFRAY, Esq. of Glamorganshire, a member of the Society, then present, was so much pleased with Mr. Morison's ingenuity and exertions, that he conferred upon him a further gratuity of TWENTY POUNDS, for which sum Mr. Morison wrote a draft at Mr. Homfray's request.